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POWER AND GAS
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VOLUME XXVII SAN FRANCISCO, DECEMBER 16, 1911 NUMBER 25

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# OIL BURNING

BY E. N. PERCY.

Many engineers and business men hear of oil burning, see records of oil burning tests with their excellent results, and read long academic discussions on oil burning without having learned in the least degree how to install an oil burning equipment on their own plant. The following article is addressed to engineers and business men in plain non-technical terms with a view to telling them how to get ready to burn oil and then how to burn it.

Oil Storage Tanks at Refinery

The first thing necessary with fuel oil is to receive it. The price must be learned, freight rate on the oil and any other necessary charges such as carting, switching, etc. Fuel oil is delivered exclusively in bulk, either in tank cars, barges or steamships. It should be an oil which has neither light volatile constituents nor extremely heavy constituents; neither should it be an oil which has been taken directly from the well without properly settling to eliminate water, gravel, and other debris. All oil has practically the same heating value; the differences being so small that they cannot be discerned except in the highest grade plants.

All fuel oils in general use ranging from 14 degrees Beaume to 25 degrees Beaume contain between 6,000,000 and 6,400,000 British thermal units per barrel, the total variation not being over 4 per cent, and that in favor of the heavier oil. Light oil has more heat per pound but less per barrel; heavy oil has less heat per pound but more per barrel on account of its weight. Therefore, heavy oil is the cheapest to use; but if too heavy will make so much carbon and smoke that there is an excessive waste.

To receive the oil it is necessary to put in storage. This may take the form of steel tanks above the ground, concrete vaults under the ground, or in small installations wooden tanks above the ground. Concrete vaults and forms may be roughly figured at 50 cents per cubic foot of concrete and the excavation according to locality and material, averaging 60 cents per cubic yard. Steel tanks including foundation, roof and setting up will cost approximately $1 a barrel.

The accompanying curves show the cost and weight of various kinds of tanks. These costs apply primarily around San Francisco Bay; for other districts freight rates, labor charges, etc., should be added accordingly. Fig. 2 shows the swing pipe and

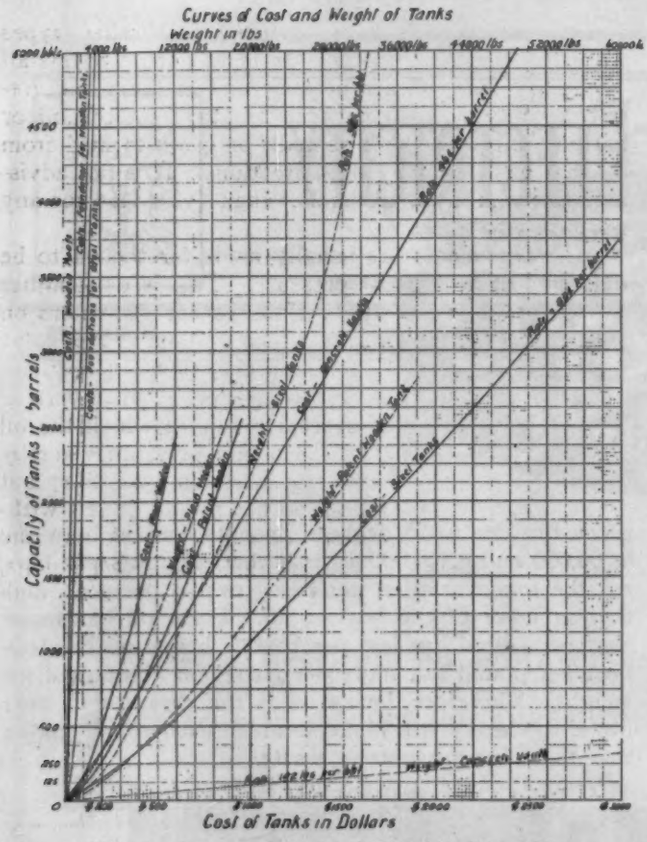



Fig. 1. Curves of Cost and Weight of Tanks.

heating coils that are used in large tanks for warming up the fuel oil.

It should be stated here that the burner is the last and almost the least important thing in an oil burning installation; the most important being ample means for heating the oil. This latter includes heat-

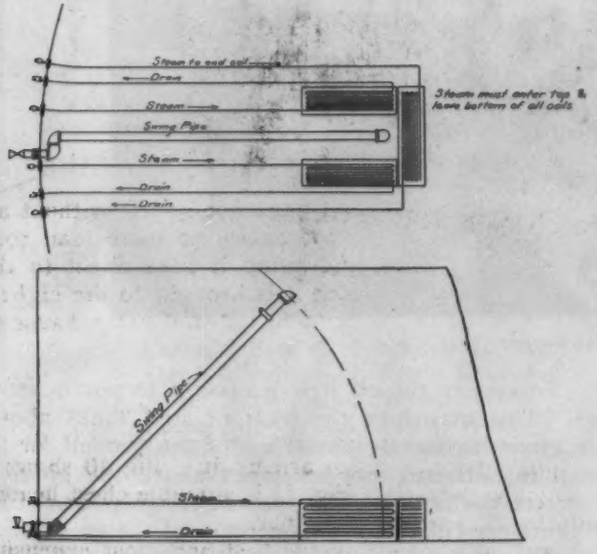



Fig. 2. Swing Pipe and Heater Coils for Tank.

ers in the main storage and a heater for bringing the oil to final temperature just before going to the burner.

By using the arrangement of heaters shown in Fig. 2 only the oil going into the suction pipe is heated, it not being necessary to heat the entire tank. This arrangement is intended for a very large installation; with a smaller installation a simpler arrangement will answer; but there should be at least one square foot of heating surface for every barrel in the tank.

Nearly always the heating coils which have been installed in a small tank will be found out of commission because of breakage or leakage. This is because they are entirely too small. The coils should be constructed of 2 in. pipe no matter how small the tank is. This is little if any more expensive than smaller pipe because the 2 in. pipe has relatively greater area.

The swing pipe is necessary only in large tanks when they are above ground to prevent the accidental draining of the entire tank in case of breakage of large pipes.

Fig. 3 shows the proper way of connecting large or small pipes through the tank shell; running threads with lock collars are not good engineering and should

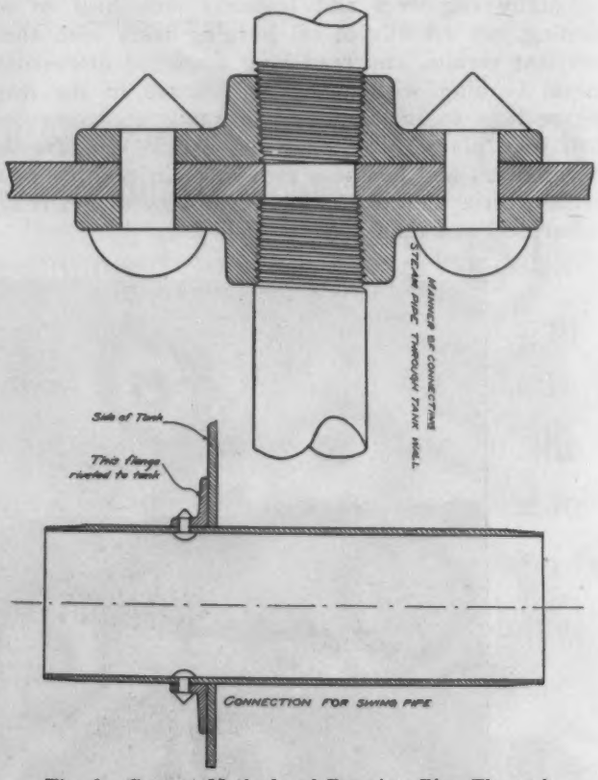



Fig. 3. Correct Methods of Running Pipe Through Tank Shell.

never be used. Concrete tanks should be reinforced and plastered on the inside with at least one inch of cement plaster. They will be a failure unless of the best construction. The underwriters and various cities have requirements in connection with the storing of oil which must be met in order to carry insurance and observe the law, to say nothing of the actual safety obtained. The first principle in this respect is that no gravity system is permissible. The oil must be stored below the level of the burners and reach same by means of pumps only.

Fig. 4, 5, 6 and 7 show various phases of permissible installations under the ordinance in San Francisco.

Having investigated the cost of delivering oil and prepared proper storage for it in accordance with the

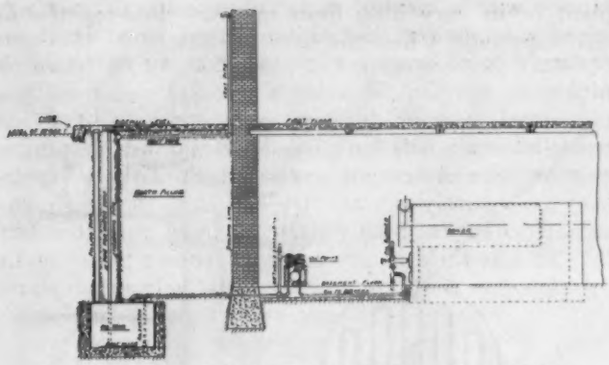


Fig. 4. Oil Tank Below Basement Floor Level, Boiler in Basement (sidewalk not excavated).

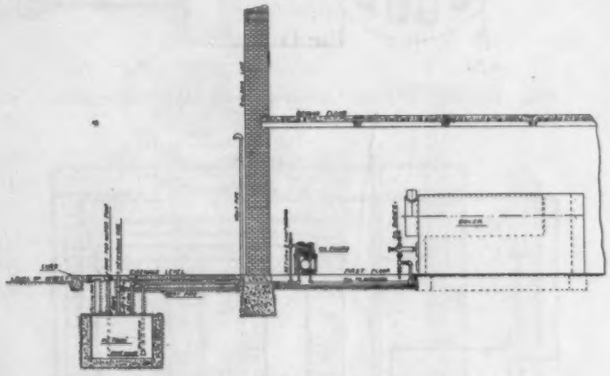


Fig. 5. Oil Tank 4 Feet Below Sidewalk, Boiler on Ground Floor (no basement).

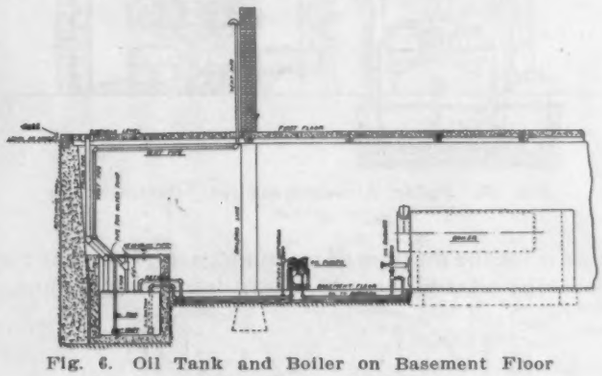


Fig. 6. Oil Tank and Boiler on Basement Floor (sidewalk excavated).

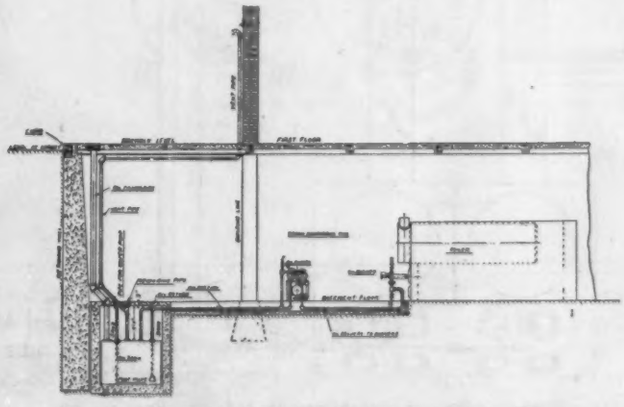


Fig. 7. Oil Tank 4 Feet Below Boiler Room Floor, Boiler in Basement (sidewalk excavated).

rules of insurance, laws of communities, and proper construction, we are now ready to pump it to the power plant. Ordinary duplex pumps installed in duplicate probably give the best satisfaction, although rotary pumps, belt-driven triplex and other types are used for the purpose. It is advisable to install oil pumps in duplicate because one of them will frequently be deranged because of gravel in the oil or valves hung open with asphalt, or gases formed from oil that has too many light fractions. It is not advisable to install a pump smaller than 4½ x 3 x 4 for any purpose whatever.

Arrangements are usually made for the oil to be delivered at a constant pressure. This is done either by means of one of the various patent governors on the market, or by means of an ordinary pop valve discharging into the pump suction. Many plants are running without any regulating device whatever.

Probably the best system is one in which the oil pressure is regulated by the steam pressure whereby the boiler automatically regulates its own fire; but this does not imply that an oil fire should be left without attention. It requires very little work and the fireman has plenty of time to do many other things, but his bench or other work should be in the fire room

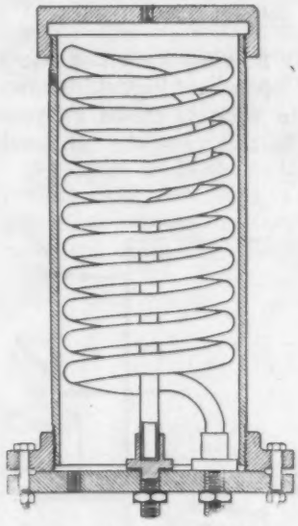


Fig. 9. Single Coil Oil Heater

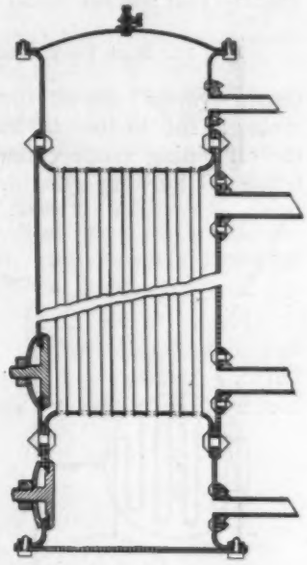


Fig. 10. Multitubular Oil Heater

and not elsewhere as oil must not be left without attention under any circumstances, no more than coal. After the oil leaves the pump it goes direct to the heater, a device in which it is brought to the highest temperature possible with live steam, not exhaust or waste steam.

Fig. 9 shows a simple type of such a heater which can be constructed by any engineer. It is not very ornamental but does the work. The oil is within the pipe and the steam around it. Fig 10 shows a multitublar heater. Fig. 11 is a double chest heater, the design of which is obvious.

Fig. 12 is probably the best and most expensive heater that can be built for large heavy work, consisting of a copper coil supported on a steel rack within a steel boiler shell bolted to a cast iron base thoroughly lagged with a non-conductor and finished off with sheet iron.

Fig. 13 shows the arrangement of steam piping in an oil burning plant. Fig. 14 shows oil piping in an oil burning plant arranged in what is called a non-

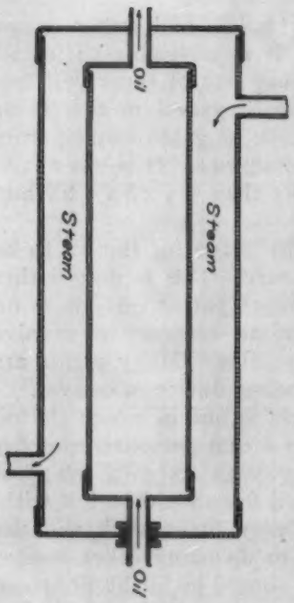



Fig. 11. Cast Iron Oil Heater

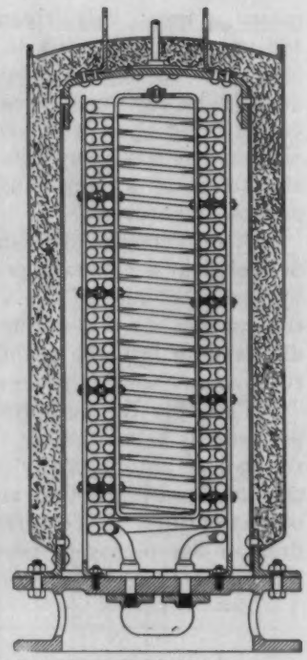


Fig. 12. High Duty Single Coil Type of Oil Heater.

return system; the oil simply flowing from the pump through the heater to the burners. Fig. 15 shows the oil piping arrangement in what is called a circulating oil burning system. In this case the oil flows

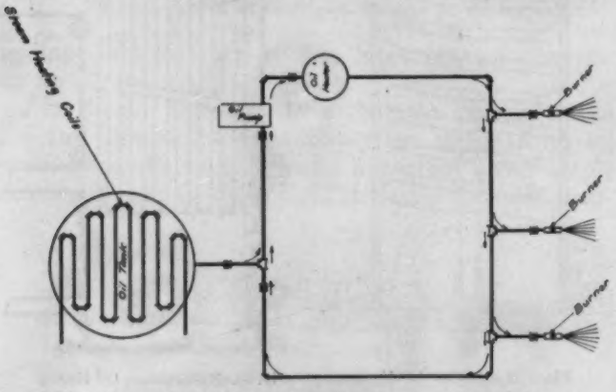



Fig. 13. Steam Piping Arrangement in Oil Burning System.

from the pump through the heater to the burners, giving them what oil they need and then flowing back to the pump suction. This is necessary in every large plant or in very long lines in order to keep the oil hot, especially when the fires are low.

Fig. 16 shows in a measure, the entire piping arrangement of an oil burning system. The oil stand-

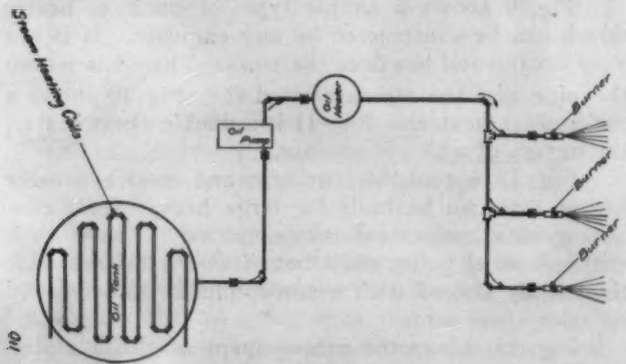



Fig. 14. Oil Piping Arrangement in Non-Return Oil Burning System.

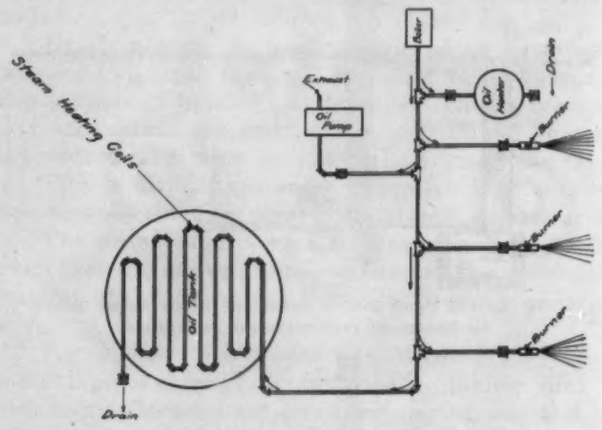



Fig. 15. Oil Piping Arrangement in Continuous Return System.

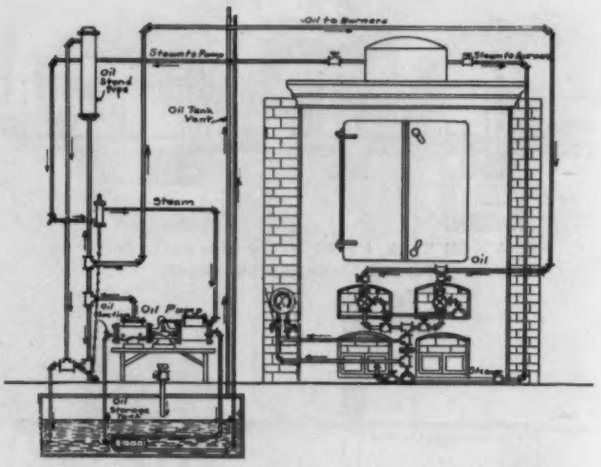



Fig. 16. Piping Arrangement for Atomization by Steam.

pipe is for the purpose of trapping gases, etc., that may be in the oil, and must be blown from time to time.

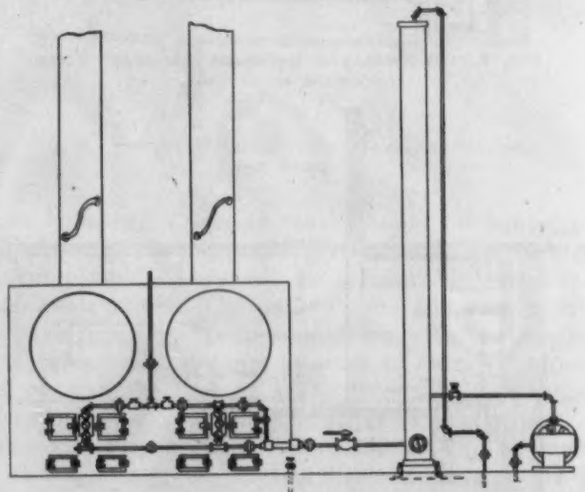


Fig. 17. Piping Arrangement for Atomization by Compressed Air.

Fig. 17 shows an oil burning system in which provision is made for atomization by compressed air.

In the most recent practice the oil and steam are not regulated within the burner but by outside valves.

The best practice calls for a burner of the utmost simplicity with regulating valves just outside of it. Ordinary globe and needle valves do not regulate well for many reasons, a valve of the type shown in Fig. 18 being much more desirable because regulation is effected by the uncovering of the diamond-shape port by the piston, but when the valve is brought to full closure it seats as any ordinary globe valve. The strainer is simply to prevent sediment from getting into the valve or burner and can be removed at a moment's notice for cleaning.

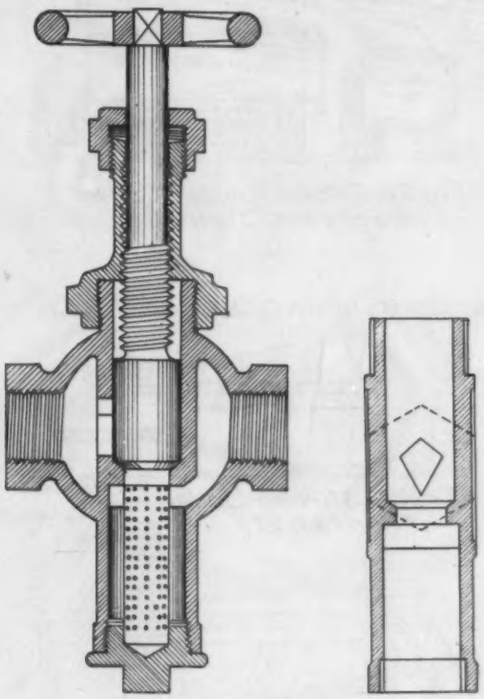


Fig. 18.

### Furnaces.

The arrangement of boiler, furnace, chimney, draft, brick work, front, and dampers is far more important than the burner, although the type of burner should accord with them and produce the shape of flame desired. Various errors still exist in oil burning as hold-overs from coal furnaces. One of these is the existence of the bridge wall. There absolutely should be no bridge wall in connection with an oil fire except in those types of water tube boilers where the bridge wall extends up to the tubes.

Fig. 19 shows an internal fired boiler that was specially designed for oil firing by making it extremely long. This method of bricking has proven very satisfactory with the exception that the bridge wall tends to throw the flame against the crown sheets, which, of course, is bad practice.

Fig. 20 shows a return tubular boiler of the ordinary type properly bricked up for oil firing, the principal features of which are that the flame has a complete unbroken sweep from one end of the boiler to the other; no air is admitted overhead, and all air must pass through the flame, it being admitted through an evenly distributed grill below a flat flame. The protection provided for the blow pipe should be noted.

Fig. 21 to 24 shows incorrectly fired boilers. Many boilers have been fired in each of these ways and have given fair service, but experience has proven that they have the following faults respectively:

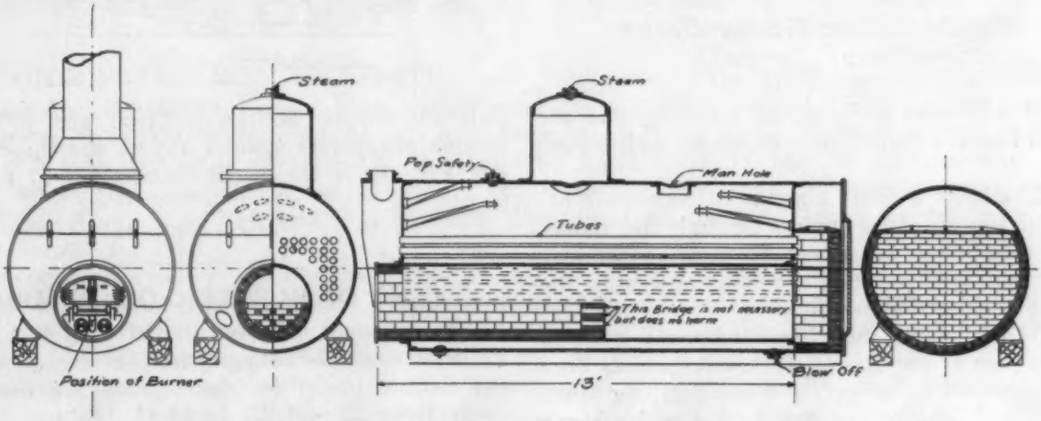



Fig. 19. Arrangement of Internally Fired Boiler Specially Designed for Oil Burning.

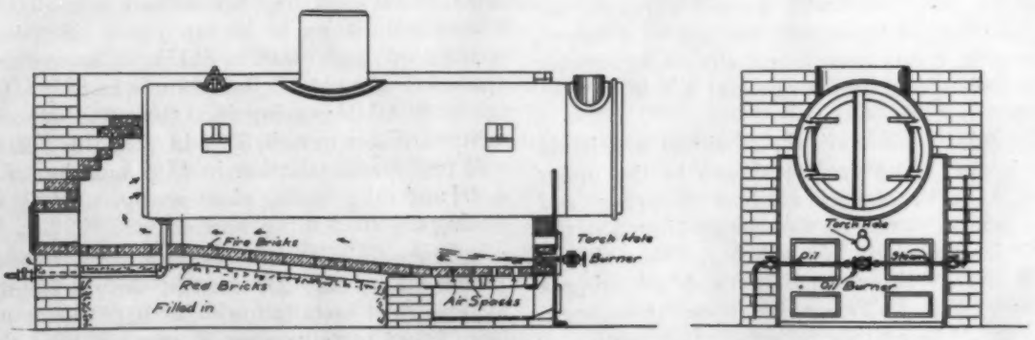



Fig. 20. Arrangement of Return Tubular Boiler for Oil Burning.

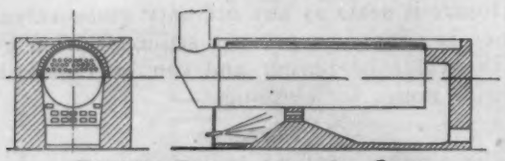


Fig. 21. Return Tubular Boiler (Bridge Wall Target)

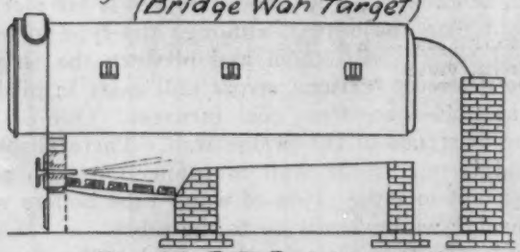


Fig. 22. R. T. Bridge Wall

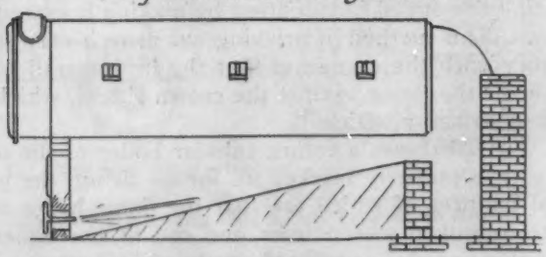


Fig. 23. R. T. Sloped

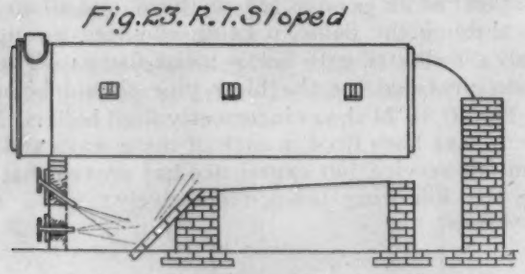


Fig. 24. Return Tubular Boiler (Frontshot Target)

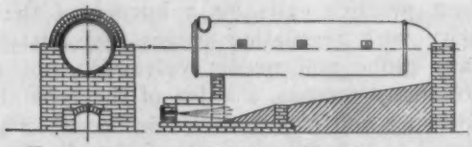


Fig 25 Return Tubular Boiler. Front Tunnel (Forward shot.)

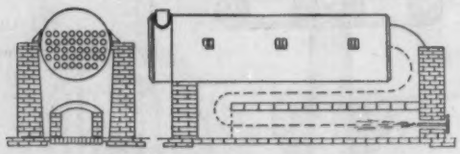


Fig. 26. Return Tubular Boiler (Backshot Tunnel)

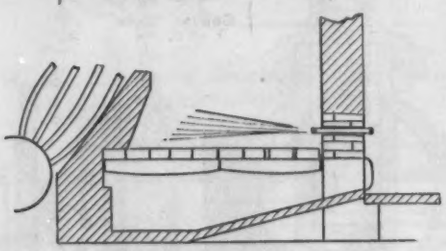
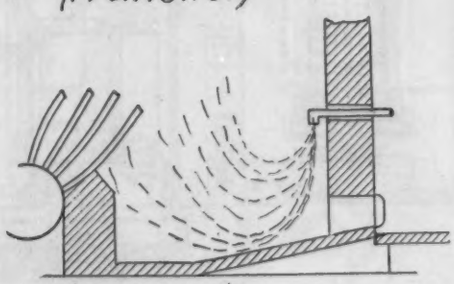


Fig. 27. Stirling Boiler (Frontshot)



(Downshot)

Fig. 21 will tend to burn the boiler around the bridge wall and the flame tends to smoke and deposit carbon.

Fig. 22 admits a great amount of excess air because all of the air does not go through the flame; therefore, this boiler can never be very economical.

Fig. 23 will tend to throw the flame up against the boiler, over-heating that portion.

Fig. 24 has all of the objections mentioned; in fact the practice of burning oil with a target has been entirely abandoned by progressive practical engineers.

Fig. 25 and 26 give fair satisfaction under heavy load because the tunnel is full of flame, is quite hot, and all the air has practically passed through the flame; but under light loads they are not so efficient, and, furthermore, it has been found almost impossible to maintain arches over the tunnels at the high temperatures resulting.

Fig. 27 shows two methods of firing a Stirling water tube boiler. The system shown in the upper picture savors of the target method of firing, and perhaps is not as desirable as the system shown in the lower sketch for extremely heavy firing.

Fig. 28 and 29 show usual methods of firing a Heine boiler. Fig. 28 being the incorrect arrangement, and Fig. 29 being the correct arrangement.

Fig. 31. 32 and 33 show various methods of firing Babcock-Wilcox boilers. There are probably no serious arguments against any of the three methods, but Fig. 31 is the usual installation in the largest plants.

(To Be Continued)

## COST OF ELECTRIC OIL PUMPING.

A statement has been prepared by the Petroleum Properties in which is compared the cost of steam versus electric power for development on the property on sections 22 and 23, in 32-33, Midway. Cost of installation and equipment $10,710, loss from discard $1000, total cost to be absorbed $11,710. Assuming life of installation to be ten years, the amount to be written off each year is $1171. The average cost of operation per month by steam was $2753.07, by electricity $1903.07; saving $850; less $97.58 amount to be written off per month, $752.42. On this basis the plant will pay for installation in 15½ months. As yet two wells and the shipping plant are operated by steam thus raising the cost of fuel and water.

The cost of steam pumping for five months, from January 1 to May 31, showing only accounts affected by electrical installation, was 10.67 cents per barrel; from July 1 to September 30, three months, the cost per barrel was 5.86 cents, a saving of 4.81 cents per barrel.

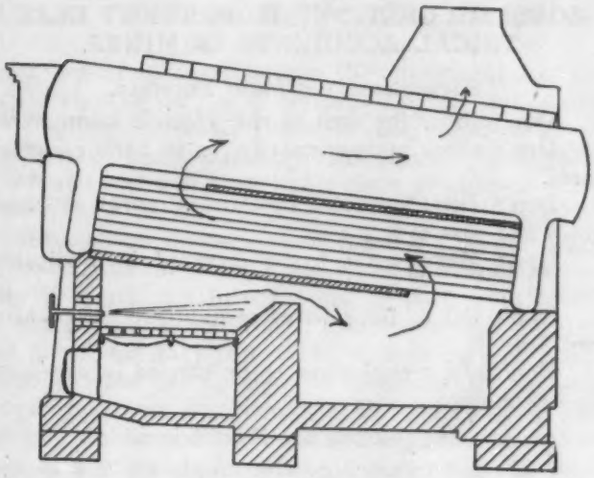


Fig. 28 Heine Boiler (Forwardshot.)

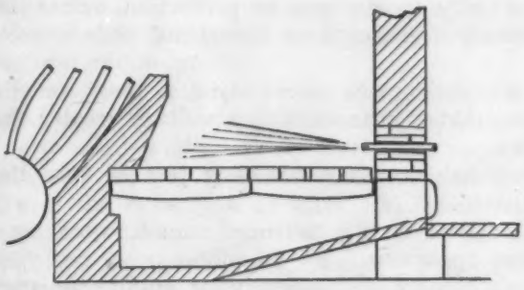


Fig. 29. Heine Boiler (Correct Firing)

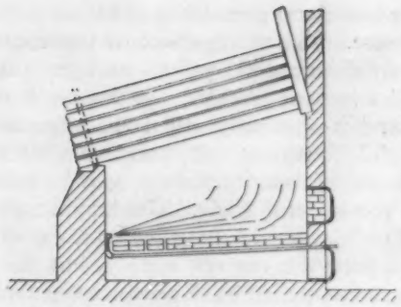


Fig. 31. B&W Boiler (Backshot)

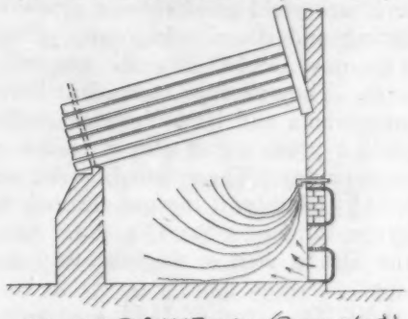


Fig. 32. B&W Boiler (Downshot)

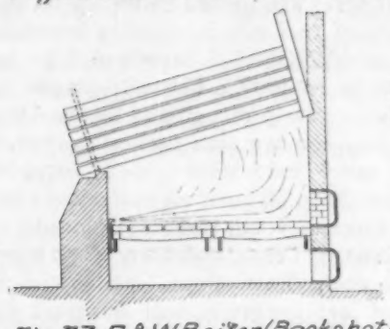


Fig. 33. B&W Boiler (Backshot)

## CRUDE PETROLEUM PRODUCTION.

More than 200,000,000 barrels of oil, with a value of nearly $128,000,000, were produced in the United States last year, according to David T. Day, of the United States geological survey, in an advance chapter on petroleum from "Mineral Resources of the United States" for 1910.

The petroleum industry in the United States, says Dr. Day, has been characterized by a phenomenal increase each year for the last four years. Each year's gain over that of the year before has been so remarkable as to lead to the belief that the limit of production had been reached, but the increase has continued rapidly. After varying between 50,000,000 and 60,000,000 barrels annually in the decade between 1890 and 1900, the oil output was over 63,000,000 barrels in 1900 and increased to 88,000,000 barrels in 1902. In 1903 it passed the 100,000,000-barrel mark, in 1904 it was over 170,000,000 barrels, and in 1905 nearly 135,000,000 barrels. After a slight decline in 1906 the output rose again, in 1907 reaching 166,000,000 barrels. It was 178,000,000 barrels in 1908, 183,000,000 barrels in 1909, and 209,556,048 barrels in 1910, a gain of 14 per cent over the record output of 1909. This brought the total output since the beginning of the petrleum industry to more than two billion barrels.

The United States is now by far the greatest oil-producing country; in fact, it produces more than all the rest of the world together. In 1910 the wells of this country yielded nearly 64 per cent of the total production, Russia scoring a very poor second with about 70,000,000 barrels, or 21 per cent. The production of other countries is comparatively negligible, the third on the list, Galicia, contributing only 3.87 per cent of the total.

The excess of the petroleum production of the United States over the normal demand is shown by the fact that the 209,556,048 barrels produced in 1910 brought a smaller return—$127,896,328—than the 183,170,874 barrels in 1909, which was valued at $128,328,427. The even smaller output in 1908, 178,000,000 barrels, was valued at still more—$129,079,184. As the production has increased the average price has gone down from more than $1 a barrel in 1900 to 61 cents in 1910.

These repeated great increases in oil production have been due to the successive development of four great petroleum fields farther west than the old productive centers. By 1900 the country had adapted itself to the influx of oil from western Ohio and Indiana; then came in rapid succession the development of the Gulf field in Texas and Louisiana, the Mid-Continent field in Oklahoma and Kansas, and the Illinois field. In the meantime California's production had been increasing so rapidly that it became the dominant feature of 1909 and 1910, outstripping the production of

any other State and promising to retain this supremacy in the future. The trade effect of these developments was largely discounted by the small proportion of gasoline and kerosene yielded by the Gulf and California oils and it was only when the superior character of the Mid-Continent oil was recognized that the middle western contributions began to be taken seriously in the general trade. Geographic and technical factors put California petroleum at a disadvantage compared with the eastern supply, but the great production has compelled such advances in refining methods as to make it reasonably certain that California will in the future yield good refined products, including lubricating and illuminating oils.

There are now 148,440 oil wells in operation in the United States. They average about four barrels a day, but in Pennsylvania and New York old wells in some districts yield a profit on an output of less than one-fifth of a barrel a day. The original Drake well, drilled in 1859, would probably, if it were cleaned, be capable of yielding one-third of a barrel a day. Another well close to the Drake well is 45 years old and is still being pumped.

Over 8,500,000 acres of land are leased for oil and 700,000 acres are owned in fee by oil operators.

The use of fuel oils is steadily increasing. Railroads consumed 24,586,108 barrels in 1910, against 19,939,394 barrels in 1909. The advantages of oil over coal have been clearly recognized by the United States navy. In new construction fuel-oil burners are being more and more extensively used; torpedo boat destroyers Nos. 20 to 50 burn oil exclusively and the battleships Delaware, North Dakota, Colorado, Utah, Wyoming, Arkansas, Texas, and New York burn oil as an auxiliary to coal. Battleships Nos. 36 and 37, authorized by the last congress, will burn oil exclusively, and it is probable that subsequent battleships will be oil burners. Dr. Day believes it to be probable that within a few years heavy oil engines of the Diesel type will be extensively adopted for marine propulsion, particularly for naval vessels, owing to recent improvements of these engines in Europe by which 1000 to 2000 horsepower can be developed from a single cylinder.

California heads the list of producers in 1910, with 73,010,560 barrels of oil, an increase of 17,538,959 barrels over the production in 1909. This output is more than twice as great as that of Pennsylvania for any year, and is greater than that of any foreign country; in fact, the production of petroleum in California and Oklahoma combined is practically equal to the entire foreign production. The average price per barrel of California oil in 1910 was 49 cents, the total value being $35,749,473. The 1909 price was 55.4 cents. The increased use of fuel oil in 1910 over 1909—more than 23 per cent—was due largely to California's energy in pushing the sales to the northwestern railroads.

The second among the oil-producing States in 1910 was Oklahoma, with a production of 52,028,718 barrels, valued at $19,922,660, a healthy increase from 1909 in both production and value.

The use of fuel oil increased in 1910 more than 23 per cent over 1909, which was largely due, says Dr. Day to California's energetic pushing of sales to the railroads in the northwest.

## SOME SUGGESTIONS TO PREVENT ELECTRICAL ACCIDENTS IN MINES.

### Suggestions for Mine Foremen.

Don't allow the men to ride electric locomotives.

Don't allow inexperienced men to handle electric wires.

Don't fail to protect the trolley wires at crossovers and partings.

Don't allow wires to be installed in a slipshod manner.

Don't fail to have wires promptly repaired after roof falls.

Don't allow explosives to be carried in cars near the locomotive.

### Suggestions for Electricians.

Don't fail to set a good example for less experienced men to follow.

Don't work on live apparatus if it is possible to cut off the current.

Don't stand directly on the ground and work upon live apparatus of any kind—get something dry to stand on.

Don't rely upon gloves for protection, unless they are perfectly dry, free from holes, and without metal parts.

Don't, under any circumstances, work on live apparatus that is charged with a voltage greater than 650 volts.

Don't handle wires carelessly just because they are insulated.

Don't send an inexperienced man to work on or about live apparatus.

Don't neglect to inspect your equipment regularly.

Don't ever cause anyone to receive an electric shock.

### Suggestions for Miners.

Don't think that it is smart to get an electric shock. Every time a man gets a shock it shows that he has been lacking in care or knowledge.

Don't be ashamed to be careful. You owe this not only to yourself but to others who may follow your example.

Don't handle wires or electrical apparatus of any kind unless you are told to do so.

Don't get off or on trips from the trolley-wire side.

Don't carry tools on your shoulders when crossing under the trolley wire or when traveling in the same entry with it.

Don't travel in the same entry with the trolley wire if you can avoid doing so.

Don't get your explosives near electric wires.

Don't allow packages of explosives to come in contact with the metal parts of cars.

Don't carry explosives in cars near the locomotive.

Don't ever cause anyone to receive an electric shock.

Don't ride on electric locomotives.

Don't fail to report when you find that electric wires are down.

Don't install temporary lights—leave that work to the electrician.

## PUBLIC CONTROL OF PUBLIC UTILITIES[1].

BY GEO. A. DAMON.

I am often asked where the movement for the public control of public utilities started and where it is going tc end. There is no question about its having been started. The people a few years ago found out that they had a right to control—they were a long time in finding it out—but there is no question about their right to control. I have heard it stated that the State has a right to everything, to your property and to my property if it is necessary for the good of the State. It even has a right to your life, for if necessary you can be drafted into the army. But the State has no right to take your life or your property without compensation, and in exercising this right of public control we still have a great deal to learn. My formula for where it is going is this: that first it is to be public control; then it is to be public partnership, and then finally it is to be public ownership, but not necessarily public operation. Let me give you some of the reasons for this belief. Public control, of which we know all too little at the present time, and which is not exercised at all in a scientific manner, especially in this State, as yet, must, to my mind rest fundamentally upon the following fundamental requirements.

First: that it should secure adequate service. Now note, I do not put the regulation of rates first. To the popular mind public control means the regulation of rates, and the regulation of rates downward. I believe in the regulation of rates and I believe in the regulation of rates downward. It is the natural tendency and we should work for it. It is the thing the engineers of this country are going to bring about, but it is not the first essential, it is the very last one. Public control should mean first, the securing of adequate service. We need better street car service, better light service, better telephone service. There is no public utility that is adequate. So the first essential of public control is a technical problem of how to secure adequate service.

The second fundamental in my mind is to protect the investment. There has been a great deal of money invested in these public utilities. There has been a great deal of time and energy put in them; we cannot confiscate that investment—that time, ability and energy; it must be rewarded and it must be rewarded at a rate something larger than simply interest rates. To determine the amount of the investment involves all of the problems of appraisal and valuation, and of depreciation, and the question of what a fair return is upon a fair investment. These are all technical problems.

The third essential fundamental to my mind is to provide some definite form of renewal account. If our service is to be adequate; if our investment is to be protected we must have some automatic system for keeping the plant up to date and up to its highest efficiency, so we must study the question of depreciation and the requirements of the renewal fund.

The fourth fundamental is the question of betterments and extensions. Some people seem to have the idea that a public utility becomes finished; that after a certain investment is made, that is all there is to it. even the bonding people begin to retire their bonds after a certain amount of development. Now take the question of transportation; there is no end to it. It is a utility that calls, as all other utilities do, for a constant source of new capital; the system must constantly be extended. From my study of the transportation systems of the entire country I found this to be true; that the earnings increase as the square of the population; that means that when the population doubles, the riding habit doubles, and if the income per capita doubles and the population doubles, the total gross income increases four times. Now every dollar of increased annual earnings in transportation means a demand for about four dollars additional investment. Take it in Los Angeles; the local railways are earning about five million dollars a year. By the time that Los Angeles doubles its population inside of the present city limits the local transportation system,—if the increase is in the same proportion as the other cities of the United States, and I believe it will be more,—will be taking in twenty million dollars a year and this increase of fifteen million dollars in annual earnings will justify an additional investment of fifty to sixty million dollars. Now we cannot get this supply of capital at reasonable rates unless the present investment is protected. So that the fourth essential requirement that the technical man must work out is some arrangement for the future which will insure an almost unlimited supply of money for improvements and extensions.

The next fundamental I shall touch upon is very seldom spoken of,—and that is the requirement to amortize part of the investment. We recognize in making appraisals that there is something more than the physical value or the cost to produce the plant; we recognize what we are pleased to term development expenses,—some people call them "intangible values." They consist for instance of the discounts on the securities, of the profits of promotion; of the cost of consolidation,—because it costs money to get together the several systems that go to make a complete public utility; they include, perhaps, a few engineering mistakes in the past that are almost unavoidable in the developing of the property, and of a number of superseded investments that do not show upon the surface. All of these development expenses may amount to all the way from twenty to fifty per cent of the cost of reproducing the plant new, but because they are "intangible" and because you cannot see them, it would be better if the capital represented by these development expenses is wiped out. So I maintain that out of the first real earnings of the plant money should be taken to retire the investment in those development, intangible values, and there should be a fund created for that purpose. This is a point that is very often overlooked.

The next essential is to eliminate competition. We at one time thought the proper method of regulating public utilities was by means of competition, and if we had a telephone company that was not giving us good service we gave a franchise to another telephone company and sought to regulate the service and rates in that way; or in the case of a lighting company that did not reduce its rates we gave another

[1]Excerpt from address before Los Angeles Section, A. I. E. E.

franchise to a hostile system. Well, what was the result? We at once had a duplicate investment; two dollars doing what only one dollar should; a duplicate management and comparative inefficiency all the way down the line. The competition certainly reduced the rates temporarily, but neither company could give thoroughly adequate service, and I think we have come to the point where we have learned that competition is not the answer. So that one of the essentials of the future development of public utilities is to eliminate competition.

Public utility service as a rule is a natural monopoly; it should be encouraged as a monopoly, but as a regulated monopoly and as a protected monopoly, but still a monopoly. But if we encourage this monopoly how are we going to most effectively control it? Fix the rates so that they are sufficient to take care of these fundamentals that I have mentioned. Make the rates high enough or refuse to reduce them until such time that the income will take care of these fundamental essentials; until we have a depreciation fund to take care of our renewals; until we can be sure that we can take care of our maintenance and operating expenses; until we can pay a proper return on the investment; until we have money in the surplus fund to amortize some of the capital, and then let us retire some of it. There should be a surplus fund created with every public utility, but that surplus fund should not belong to the company. To my mind there is where scientific regulation can do its best work. Let the control of this fund be put in the hands of a technical commission which understand the business, and what will be the result? If it wishes to renew some of the property or replace some inefficient part with something that is more efficient so as to cut down the cost of operation, this fund will be sufficient for that purpose. If it wishes to extend the system into parts of the city where for a time there will be a non-paying load, that fund is available for that purpose. If it wishes to amortize some of the capital so that the fixed charges will be reduced part of the fund can be used in that way. A surplus fund of this kind would give a stability to the whole enterprise. Finally, when the fund gets sufficient to do all these things, then is the time to reduce the rates and the reduction of the rates will naturally follow, because both the fixed charges and operating expenses have been lowered. While the whole program tends towards the reduction of the rates it does not put the reduction of rates as the first essential.

If the surplus fund of the public utility corporations is thus controlled and at the same time the investment is made stable by insuring a return on the actual value of the property, then by this very arrangement the public enter into a partnership with the utility company.

Now this is not an idle theory, for it has been worked out in actual practice. We have practically this same arrangement in the Chicago traction situation. In working out the transportation problem there, a contract ordinance was entered into between all of the railway companies and the city in which the railway companies were practically operated as a protected monopoly. The companies were allowed five per cent return on their actual investment and the surplus fund was then divided; fifty-five per cent to the city and forty-five per cent to the company. The company was required by ordinance to maintain its property and have a sufficient renewal fund; and in making the arrangement the intangible values were given a certain value, and incidentally a great many of them were amortized at that time. Today the City of Chicago and the railway companies are in partnership, and the City of Chicago takes fifty-five per cent of the net earnings and is accumulating a fund which is available to either build sub-ways, to extend the service into non-paying districts; to reduce the fare if they wish to, or to buy out the company. So public partnership may actually end in public ownership; because after the public has learned the business and has treated the men who taught it the business right, it may finally say to Mr. Public Utility Man, and particularly to the promoter and the capitalist,—"Now don't you think you would like to take your money out of this enterprise and go into the flying machine business where there is a possibility of your making more money, and let us run this thing on a five per cent basis?"

But I want to warn you that there is a danger which every operator of every utility realizes today. The trusted employee will say, "What is going to become of me?" I don't want to work for the public; I don't want to play politics to keep my job." And to my mind if this evolution does end in public ownership and operation of these utilities there will be danger. I see only one way of overcoming it, and that is after we get public ownership then eliminate public operation and turn over the operation of these utilities to strictly operating companies organized without any necessity of raising capital or of financing, or of getting franchises, or of going into politics.

The State of California has voted to extend the duties of its State Railroad Commission so that it would have the powers of regulation over all of the public utilities in this State. The Railway Commission of Wisconsin have similar powers and its work commands the highest respect. Why? The Wisconsin Commission turned over its technical problems to an engineering organization which is controlled by the professors of the State University. From the first it built up a fabric of decisions based often upon the reports of its engineers. The result is that, in the State of Wisconsin the public utility business is in a state of balance.

California has an equal opportunity. Whether we are to have a State Commission which will be wise enough to bring about this result I don't know, but they have this Wisconsin precedent before them for their guidance. Personally I should be glad to see them take as their technical assistants the professors and technical organization of our State University. I should be glad to see that State Commission so efficient in its work, so careful in its judgment and thus commanding the confidence of every citizen that even Los Angeles itself would feel impelled to turn over its problems of regulation to a State Commission which would be entirely free from any local political influence.

## DISCUSSION.

To the Editor: Your editorial, entitled "A Reply to Richard R. Crane," has been read with much interest. It was just to the point, and I am glad you found time to put down a word in protest to the views expressed in that publication, which, if not written by a great man, would be considered ridiculous by most people, and no attention paid to it.

When Mr. Crane talks about the Universities, he is evidently thinking more of business colleges and at the same time he has his own business too much in mind to be general. If he had said in his paper, that he in his business had no use for technical school graduates no one could have criticised him, as the articles in which he specializes certainly do not require technical skill to any greater extent than the manufacture of wheelbarrows on a large scale.

Mr. Crane seems to kick the electrical engineer the hardest. He seems to think, among other things, that the General Electric Company and the other big electrical concerns are frauding the young graduates, when they keep them in their testing rooms for two years at a small pay. This is, however, just the place, where they are constantly surrounded by an electrical atmosphere as Mr. Crane recommends himself, and where they have a chance to absorb in two years what it has taken the great men a lifetime to develop. Very few men are great enough to educate themselves, so the majority would either have to do without an education or go to "the technical school." But even the few who were able to educate themselves would surely go to the technical school if they had the opportunity—to save time, if for no other reason. It happens frequently that the "school teacher" is one of the best engineers in the country, who used to be connected with some of the largest and finest manufacturing establishments in existence before he took up teaching in the technical school. This fact at once excludes the possibility that his knowledge and what he has to say to the students should be merely humbug theory.

The method Mr. Crane suggests for the making of an engineer would perhaps do in the plumbing business, but in very few other lines of business would it produce a successful engineer.

Lars Jorgensen.

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## CHELAN DAM SITE UNSATISFACTORY.

The site selected by the Great Northern's engineers as preferable for the big dam to be built in the Chelan River gorge to develop the water power of Lake Chelan and the Chelan River, will probably be abandoned if any other reasonable good site can be found. Extensive prospecting discloses the fact that the bed rock is badly broken up and displaced. A thorough examination of the walls is now being made for another location farther up the canyon. If a better foundation cannot be found elsewhere the dam will probably be located on the site originally selected, but in that case deep and expensive excavations will have to be made.

## HIGH TENSION DIRECT CURRENT TRANSMISSION.

Discussion by members San Francisco Section, American Institute of Electrical Engineers, October 27, 1911, of paper by C. F. Elwell, as published in this journal, Nov. 18, 1911:

**S. J. Lisberger:** Mr. Elwell has presented some interesting facts on this question. One thing he has omitted to mention, that is, the relative floor space required for the two systems, the a.c. versus the d.c. Have you any comparative figures on that?

**C. F. Elwell:** No, I have not worked that out. The most noticeable thing in entering the station is that you see nothing but machines. The switchboard is stuck away in a corner. You can figure on the space for your machines, and then add a 4 foot panel for the switchboard. I think the direct current system would compare very favorably on the question of floor space.

**W. F. Lamme:** Would this system replace what we have here on the Coast?

**C. F. Elwell:** This direct current is not a cure-all, but there are certain cases to which it applies. For instance you could have a number of stations scattered through the country and if they could be arranged in a ring, you could put up a pole line which, not having any cross-arms on it and one insulator and a fairly heavy cable, would be less expensive than ordinary pole lines. They do not attempt to distribute by direct current. They transform it back to alternating current for distribution.

**W. F. Lamme:** What kind of coupling do they have?

**C. F. Elwell:** The coupling is known as a Rafford coupling, and is made by having two discs each with a series of pins and leather belting between the pins, which take up the shock in starting, and also give sufficient insulation between the machines for the whole potential.

**W. F. Lamme:** Is that able to take care of 25,000 volts?

**C. F. Elwell:** Yes. They made tests on couplings with a space of eight inches for 100,000 volts.

**S. J. Lisberger:** Are the generators and motors shunt wound?

**C. F. Elwell:** No, they are all series.

**S. J. Lisberger:** What happens when they lose the load?

**C. F. Elwell:** If the line opens, and one end touches the ground, that elminates some of the load. The machines will keep 150 amperes on the line in spite of anything. They will back voltage if it is a dead short near the station, until they only generate a few volts.

**S. J. Lisberger:** I don't know that I would agree that that is a great advantage. How do they take care of sudden changes of load at this plant?

**C. F. Elwell:** They will take care of themselves automatically. There are few sudden changes possible. Suppose a cement mill were about to shut down. They back off the brushes; that is one gradually, reducing the voltage. Finally when they are down almost to zero volts they close the short circuit switch, and there isn't any great change of load.

**Question:** Suppose you have a motor in series with a generator—alternating current generator; suppose that generator suddenly loses load. If we have one of these motors in series with a high voltage line driving an alternating current generator, suppose the alternating current generator should suddenly lose its load, how would the motor act?

**C. F. Elwell:** I should say this automatic brush regulator is very fast in its action. It would immediately back down to a few volts necessary to revolve that machine with no load. There may be a little sparking. I have seen some fairly large fluctuations in voltage. Of course you don't see anything to speak of in current. These regulators follow the load very fast. You may see the voltage drop from 23,000 to 19,000 volts, and as they throw the load in again it comes up very gradually.

**Question:** How quickly does the regulator work?

**C. F. Elwell:** There is no reason why the regulator won't work very quickly. There are a large number of cogs in the wheel, and every cog is quite small. That means that you can get a very small percentage change. It is driven by a motor at fairly high speed.

**S. J. Lisberger:** How are those armatures wound?

**C. F. Elwell:** They are drum-wound armatures. The pictures here will give a better idea of some of those points.

**Mr. McCann:** As to what Mr. Elwell said in regard to corona in alternating current, he speaks as though there wasn't a corona limit in direct current. In Mr. Watson's paper before the British Association for the Advancement of Science at Winnipeg, in 1909, he gave the results of a good many experiments on direct current corona losses; and he says the maximum voltage applied to the wire determines the formation of corona; and whether that voltage is applied continually in the form of direct current, or comes as a maximum twice in the cycle, doesn't make any difference. It is merely the maximum voltage that the corona depends upon, whether it is direct or alternating current. In the same way you would reach a corona limit with direct current I should think. Of course the voltage would be higher.

Another point I would like to find out about is about commutating. In a discussion of a paper on this subject Dr. Kapp seemed to think that for a concentrated commutated field motor complete compensation for armature reaction would overcome the sparking at the brushes while it was on the neutral point; and I was wondering whether they had tried that out in their generators. They evidently had not tried it out at the time the paper was published, and he suggested this as a remedy for that.

Another thing I would like to ask about is the metering of the power. In alternating current there is considerable difficulty, especially in high tension of course, in regard to rate change, and also phase angle, when you use certain shunt transformers. That would be entirely done away with. It seems as though the meter would be better and more satisfactory with direct current.

**C. F. Elwell:** I think Mr. McCann's point in connection with corona is well taken.

As to the point he brought up about Mr. Kapp's discussion on commutation, Mr. Kapp has had quite a little to do with the designing of these machines mentioned tonight, and they work those machines at about 50 volts between bars, which is considered pretty high voltage; and my experience has been there is very little sparking with them. The brushes follow the changes in load with almost no sparking; and as far as the attention to the commutators is concerned, they tell me they only touch them about once a year. They showed little signs of wear. Of course they are slow speed machines. That is one point that is a question. This subject has only been touched, you might say, in one spot and by one man. With many men on this thing great progress should be made. The people over there have built 25,000 volt machines for testing purposes, and they were built with rotary fields and stationary armatures; and there is no telling what we may do when we get after the problem. I am not ready to discuss the commutation problem in detail at this point.

About the metering, they have an ordinary integrating meter. All the stations that use the current have meters. They just have one meter in each place.

**Mr. McCann:** I was referring to the load.

**C. F. Elwell:** They shunt the line, and the shunt follows the voltage. The shunt would have probably only two or three volts on it, the current is constant, the voltage only varying.

**S. J. Lisberger:** American motor practice has always been against—or rather not in favor of the use of a shunt in connection with motors. I don't know of any American motor, with possibly one exception, that uses shunts. The claim has been that the change in the temperature in the shunt has caused such a variation as not to allow correct metering. In the case of direct current motors up to 5000 or 6000 amperes, no shunts are used. I should think that errors that might result in the use of shunts in the direct current system might render them open to as large a percentage of error as Mr. McCann mentions in the discussion of phase angle in commutation transformers.

**W. F. Lamme:** I saw Mr. Elwell's paper this afternoon, and looked over one particular commutator with 999 bars. It figures out that the bars were 1/16 in. thick. Putting 999 bars 1/6 in. thick in a circle, insulated for 5000 volts, it seems to me, would give a lot of trouble on account of getting out of shape. I would ask Mr. Elwell if he knows of any case of trouble of that kind. In this country we have had trouble with that kind of machinery for experimental purposes. That was one of the troubles we had, to keep the commutator in shape, but it is possible that the people in Europe have learned something we did not know.

**C. F. Elwell:** The commutators over there have what I would call a very deep bar; the bar is very thin but quite deep. There is not apt to be the distortion that there would be in a shallower bar; but as far as wear is concerned on the bars the ones I examined when the machines were shut down were of a nice chocolate color, and seemed to be in perfectly good order. They are all slow speed. The fastest speed is approximately 420 revolutions per minute.

**Mr. McCann:** The question of metering, especially with regard to calibrating meters. On an alternating current you can calibrate the induction meter so it works all right, but still if it is not put on the proper potential coil and they are not loaded properly, it won't bridge the power properly. It is practically impossible at the present time to calibrate it on the ground. It seems to me that the direct current meters could be calibrated on the ground without great difficulty. I would like to ask as to the peculiar construction of the poles of the machines. The windings are between the poles instead of on the pole itself.

**S. J. Lisberger:** Mr. Elwell spoke of an insulation with reference to underground cables, and gave us certain thicknesses. May I ask you to repeat the thicknesses in that class of insulation?

**C. F. Elwell:** With an insulation consisting of the usual tarred hemp and jute, and a little rubber, in tests they have had 4 millimeters of insulation, which they could not break down with 100,000 volts. I might mention here that they tried an insulated armored cable placed under water, with junction boxes inserted, at 300,000 volts.

**S. J. Lisberger:** Do they use lead sheath?

**C. F. Elwell:** Yes, nearly all lead sheath cable.

**S. J. Lisberger:** You said they used hemp.

**C. F. Elwell:** Yes, hemp on the outside of the cable That cable was put down about 1905.

**S. B. Charters:** You spoke of the possibilities of using a ground return. What are the advantages and disadvantages in that connection? There must be some, or it would be used altogether.

**C. F. Elwell:** I have a report of the Commission on Earth Return from which I will read in full, and you can judge for yourselves. The report says:

**Report of the Commission on Earth Return.**

At its last full session, 20th of June, 1909, our commission learned with pleasure that the few difficulties which

opposed a continuous trial of the transportation of energy from St. Maurice to Lausanne had been removed and that the Inspector of Telegraphs of the C. F. F., after having recognized the efficacy of the compensation cells placed as a trial in the stations at Aigle, Allon St. Triphon, Bex and Monthey, was willing that we use the earth permanently as a return conductor for the constant direct current of 150 amperes which characterizes the Lausanne transmission.

It was from that time in our power to study certain points in the program which we had mapped out since the commencement of our operations and the solution of which could only be furnished by trials of this nature. As we have already said in our last report, the trial with the earth as return commenced at 1 p. m., July 23d, 1909. We are pleased to be able to verify at the first trial that the earth as a return was faultless, and that we have been able, after 10,000 hours of actual operation to make some interesting observations.

We are naturally not able in a simple administration report, to enter into many details and quote numerous figures. This will be taken care of in our general report, at any rate the part relating to continuous current. We will be contended here with relating some of the more salient facts which we have been able to make during this last year.

A.—Earth Connections.

We recall from the very first that each of our two earth connections comprises in all 18 units in three groups of six of the same nature in parallel. At Bex as at Belmont, the six units of Group 1, consist of metallic gratings filled with slaked lime covered with large pieces of coke. The six units of Group 2, consist of cast iron pipes covered with scrap iron and those of Group 3 of cast iron pipes, but covered with large pieces of coke instead of scrap iron.

B.—Equivalent Resistance of the Earth Connection; Distribution of Current Between Connections; Wear and Repairs.

Up to the present time no modification of the number of connections in circuit at either Bex or Belmont. The service is therefore continued with 18 connections in parallel at each end of the transmission.

It was necessary to get information above all on how the connections behaved in continued service. We accordingly arranged for some continuous and some periodic measurements so that we could at all times know the equivalent resistance of each of the connections and the distribution of that current among the 18 units of each connection. Each of the latter is equipped with a recording voltmeter which records exactly, as a function of the time, the behavior of the fall of tension either between the earth connections at Bex and the auxiliary earth connection at St. Legier or between this last and that at Belmont. A recording ammeter placed in the busbar of one of the groups of the earth connection at Bex, permits us to follow the variations of the current in the circuit as well as the fluctuations of the current between groups when they exist. Finally at relatively regular intervals we measure the current in each of the 18 units and that permits us to decide if there is any wear or any other cause of derangement.

**Earth Connection at Bex.** This earth connection constitutes the negative pole of the return conductor. It is located in a relatively homogeneous but rather badly conducted ground, as our first experiments of September, 1906, and May, 1907, have shown.

At the first of these dates, when the Valley of the Rhone was inundated, we measured a fall of potential of 122 volts between the connection at Bex and St. Legier. The return conductor for the current, that is to say the earth, between one of the units at Bex and the equipotential surface passing through the auxiliary earth connection at St. Legier, has thus an equivalent resistance of 0.813 ohms.

In May, 1907, when the country in the Valley of the Rhone was almost dry, the fall of potential was 163 volts, between the same two points or an equivalent resistance of 1.087 ohms.

There was thus an increase of resistance of about 34 per cent between the two dates. The cause of this variation could only be the difference in the humidity of the soil. It could not be near to the earth connection, for on one hand they were at the negative pole and on the other the earth return was only used about 20 hours altogether. But if we thus fix on the cause of the variation, we have yet to explain its amplitude. Care was taken to record the level of water in the pipes which formed the essence of the earth connections, each time the potential was measured. We have thus watched the full of the potential increase proportionately as the soil dried up to a greater depth and on the contrary decrease as the phone increased or heavy rainfall near the earth connections.

When the regular use of the earth return commenced July, 1909, the Valley of the Rhone—it is always thus at this time of the year—was inundated for quite a distance around the earth connections. We measured then a fall of potential of 125 volts between Bex and St. Legier (equivalent resistance of 0.83 ohms). A curious fact is to be noted here. On returning to Bex a few days after we found a multitude of earth worms, which driven out by the current, had died outside the earth connections. We also noticed a strong liberation of hydrogen.

The indicating voltmeters showed that since this time the fall of potential increased gradually and proportionately as the waters lowered. In August, 1909, it attained an average of 130 volts; in September, 135 volts; in October, 142 volts; in November, 160 volts; in December, 165 volts; in January, 1910, 170 volts; in February, 185 volts, with a maximum of 190 volts (equivalent resistance 1.265 ohms) on 18th of February, 1910. From this on the fall of potential gradually decreased to a minimum of 115 volts (0.77 ohms) during the floods of last July.

The above few figures show that the fall of potential between Bex and St. Legier and consequently also the resistance of the corresponding piece of circuit, since the intensity of the current in this maintained constant, has varied tolerably in this first year of use. The total variation represents about 65 per cent of the minimum of 115 volts. Taking the mean values as a point of comparison of the fall of potential or resistance, we arrive at a variation of 24 per cent.

It will be interesting to see how things will go in the future. We would not be surprised to see these variations attain greater values yet for last winter was not very vigorous and the entire year has been particularly humid. We will, therefore, continue our observations and will measure, wherever we are able, the fall of potential between the earth connection at Bex and an auxiliary earth connection which we will place in the neighborhood. In this way we will know if the proportion of potential Bex-St. Legier and Bex in auxiliary earth remain constant, or if on the contrary, the variations of resistance take place only in a zone immediately around the earth connections.

The 18 units at Bex are in good shape up to the present time. We have not noticed any wear, which is not astonishing, since as before noted this is a negative pole of the path to earth. No repairs have been made to these connections. The only expense which they have occasioned, outside of the instruments which were placed there, was due to the theft of four copper wires of a few inches each, which theft was shown by the recording instruments to have taken place on the 14th of October, 1909, at 4 p. m.

This incident warrants at least an explanation. In the zone of the earth connections the potential only varies a little and in ordinary weather there is no danger in touching any one of the 18 wires which join the line to the earth. We did not therefore take any precautions to prevent access and to tell the truth did not foresee that any thief would judge conditions so accurately as to profit so adroitly. But said personages had not counted on what happened as they progressed with their work. As each wire was cut, the potential between conductors and any point of the ground and the currents in the wire increased considerably. It sufficed to develop in the hands, if not in the conscience, alarming and increasing prickly sensation. The sparks becoming faster and more alarming after the fourth wire was cut caused them to leave an operation which they felt must become more dangerous. We have increased this conviction by fencing off the connections and placing a sign, the tenor of which every engineer knows.

**2. Earth Connection at Belmont:** The earth connections at Belmont are located in ground, which although passably marly is better conducted than the Valley of the Rhone. Since the trials of the 25th and 26th of May, 1907, we have observed a fall of potential of about 95 volts between Belmont and the auxiliary earth at St. Legier. The resultant resistance between this earth connection and the equipotential surface passing through St. Legier was about 0.63 ohms.

During this year of trial the fall of potential between these same points has varied relatively little. The extreme values observed were 83 and 107 volts. On the other hand these variations have not followed any well defined law and this is easily explained. The ground at Belmont shelves down quite markedly. The run-off is therefore prompt and small seepage prevents large variations of the resistance of the soil. The variations of the fall of potential Belmont-St. Legier have accordingly been more variable than at Bex where the variations were of lower duration. Besides the connections at Belmont, which constitute the positive pole of the earth return path, have been partly destroyed by electrolysis and partly modified in their structure by earth slides or currents of water and it is probable that these are the principal factors in the variations of resistance in this portion of the path. The units in metallic screens suffered the most. Two of them were almost completely electrolysed and have been replaced by two units filled with coke. Three units of group 2 (pipe and scrap iron) have also suffered from wear and bad contact. The scrap iron has been replaced with large pieces of coke or coal dust. Finally 3 units of group 3 (pipe and coke) have had to be replaced for lack of cohesion between the coke and the pipe.

These repairs have not necessitated any stoppage of service: They have been made easily and at little expense. The wear by electrolysis, has been extremely small, considering that 5400 mega-coulombs have passed through these units since their use as earth return.

We have already had occasion to say, that the earth return has worked without any mishap since it was placed in regular service. There has not been during 14 months any derangement due to it, even at St. Maurice where the tension reaches up to 23,000 volts. It has not been necessary ever to resort to the two-wire service and the chief of electric service at Lausanne does not see any reason why the earth cannot be used as a return indefinitely. On the other hand the inspector of telegraphs has made no complaint. Thanks to the compensating batteries installed at Aigle, Allon St. Triphon, Bex and Monthey, batteries which have worked so well up to now, that the railway signal service has been made as under absolutely normal conditions.

We should then be satisfied with the results and our commission is happy that the work had led to such a decisive result. The work was facilitated by the good will and cooperation of the official of the federal telephone and telegraphs, more particularly the City of Lausanne and the Chief of Electric Service.

The Commission will continue to observe in an attentive manner the working of the St. Maurice-Lausanne transmission and will not fail to make any useful indications.

**A. J. Bowie:** I would like to ask if there is any trouble with the insulation of the small motors on the line?

**C. F. Elwell:** The earlier generators and motors were mounted on regular insulators, that is, a petticoated insulator put upside down, and it was found that these were cracked, and now they adopt the method of mounting the whole machine on a slab of insulation, covering the whole floor around the machine with a couple of inches of asphalt. The floor of the house is covered with vitrified tile. It has one disadvantage, that the machine becomes charged statically.

**Question:** How about the effect of electrolysis on gas pipes and water pipes?

**C. F. Elwell:** I mentioned before, no repairs have been made to them in fourteen months.

**Question:** Wouldn't it attack them if they happened to be adjacent?

**C. F. Elwell:** They evidently had that in mind in making the earth connection. St. Maurice is quite a fair sized town, and so is Lausanne, and they went out of both places several miles before taking to the earth as a conductor, evidently to avoid any trouble from electrolysis in St. Maurice and Lausanne. Between those two cities there was no town of any importance.

**A Member:** In regard to water pipe electrolysis, I read an article about this system. The way they overcame that was to insulate their cable down to a ground plate, which was several feet below the surface of the ground. In that way the current passed in a path that was considerably below the adjacent pipes and so forth, and in that way it had no effect. They insulated the cable down to the ground plate.

**S. J. Lisberger:** What did you say was the maximum voltage they had current on any one of these direct current systems?

**C. F. Elwell:** The existing system, the one that has been in operation for five years, 57,600. They employed that on the same size insulators that they used on the 26,000 a.c. line.

**S. J. Lisberger:** Then they are not capable of delivering very much power?

**C. F. Elwell:** With 150 amperes at 93,000 volts they will have 15,000 kilowatts. I don't see why they could not generate 45,000 kilowatts.

**Question:** I would like to ask, referring to the diagram, does each of those stations represent a generating plant?

**C. F. Elwell:** No, these represent generating stations, and these three receiving stations. This diagram shows the connection of one group. Here are the armatures in series, and the ground points of the armatures are grounded to the system through these coherer resistances, and the only apparatus, as you see, is this commutator form of switch. You swing it round in the upper position and the line is short-circuited; and you swing it sideways and it is in series. That is all of the details that exist in connection with the set.

**Queston:** The distance between the generating and the receiving stations is what?

**C. F. Elwell:** 112 miles, and you can see the voltage ratio in that connection. They have for five years worked 112 miles with 57,000 volts.

**A. J. Bowie:** Has Mr. Elwell any figures as to the relative cost of machinery of this direct and alternating current?

**C. F. Elwell:** I can only give you something that was worked out several years ago by an engineer in London, and presented before the English Institute. I will translate the figures into dollars. He takes the power station of an alternating system. In a 14,000 kw. station (you must recognize this is five or six years old) he takes 14 1000 kw. machines—which is not necessary. We won't take that one. In fact none of these figures are worth much because he takes so many units. In a 37,000 kw. station he takes 20 units; 37,500 kw. a.c. 10 units, 3750 kw. d. c. 20 units (just half the size); a.c. units and kilowatts; d.c. 20 units (just half the size); all buildings for a.c. £87,000; d.c. £103,000. Generating plant, a.c. £200,000, and d.c. £325,000.

But that is not fair to the d.c. under the circumstances, if you can get larger generators.

Switch gear, a.c. £8700; d. c. £1300.

Boilers, auxiliary and coal handling plants, a.c. £164,000; d.c. the same.

Total cost: a.c. £473,000, against d.c. £594,000, which I think is too high for the d.c. on account of his selection of so many generators. But granted that, the d.c. station will always cost more money than the a.c., the great saving being in the line. Taking the figures for a unit line based on 85 per cent power factor for a.c. and the same equivalent voltage, for example, 25,000 volts a.c. and 35,000 d.c., if it takes a thousand tons of copper for a.c. it will only take four hundred tons for the d.c., and the spacing not being a factor, it is not necessary to put up large cross-arms.

**H. W. Crozier:** I have been very much interested in the discussion tonight. I am sorry I did not have a chance to see the paper beforehand, because there are two or three figures I want to refresh my memory on; but if I remember exactly there was a 350 mile transmission proposed to furnish power to the Rand mines in South Africa, and this direct current system was considered very favorably; in fact the three-phase system could not deliver the goods. The final solution of the problem however was the building of a large steam power plant about 100 miles from the mines, and the abandonment of a hydraulic plant, the principal reason being the cost of copper.

Now getting down to California conditions again, some time ago, in the consideration of building a large transmission line to San Francisco and Oakland combined the question of crossing San Francisco Bay with cables was taken up very carefully; and as I recollect the figures, it was proposed to deliver about 20,000 kilowatts. The cable men figured on 12 cables, each about 3 inches in diameter. They would be single-phase cables, and the capacity of each group of three cables would be 5000 kilowatts. On account of leakage the loss would be about ten per cent. This matter was gone into very thoroughly, as the cables would be a main link in a large transmission chain; but the matter was abandoned, and the power brought in by building a transmission line around the lower end of the Bay.

The problem is now up again; and it seems to me from this discussion tonight quite a field open for this method. An 150 ampere line at 66,000 volts could transmit 10,000 h.p.

In our problem of 12 cables I have forgotten the amount of money involved; but our problem of 12 cables has now come down to two cables. In view of the fact that we are now going to build a Fair here, and these people with so much experience in this matter will probably be among the exhibitors, it might be in order to request them to attempt such a thing.

Aside from this, there is also staring us in the face in California long transmission of 200 miles and more. So far, our experience has been very satisfactory up to 150 miles, and we have been able to control and deliver voltage with synchronous apparatus. We get down to the situation of generating a lot of current and then transforming it. In the case of the Turk and Fillmore street powerhouse, we take 11,000 volts into the station and turn it into direct current. I don't see that it would take a great deal more machinery to take in direct current.

**Question:** What has been the effect of lightning storms on this system?

**C. F. Elwell:** As fas as I know, there have been no shut downs from that cause. As you will see, they have plentiful protection, having three kinds of lightning protection, horn gap, condenser and coherer resistance. Anyone who has been in Switzerland knows what lightning is. Nothing in California will compare with it. I have heard of no troubles of that sort. Certainly there has never been anything get into the machines. They seem to be amply protected from any disturbances on the line coming back into the mechines.

**Question:** May I ask about the Victoria Falls proposition in Africa. They claimed they could not make it with alternating current on account of the great distance and the power involved.

**C. F. Elwell:** That is the system that Mr. Crozier referred to. That was gone into by a corps of experts several years ago. It has been abandoned for the present.

**Question:** There was no decision made on it?

**C. F. Elwell:** The decision was, as Mr. Crozier said, to build a steam plant at a little distance from the Rand and supply the power in that way. The power is still there, and some day it may be utilized.

**Mr. Nielsen:** Mr. Elwell stated that there would be no corona losses with high tension direct current transmission. I would like to ask Mr. Elwell whether they have had any troubles with this on those lines over there. Mr. McCann referred to a paper by Mr. Watson before the British Association at Winnipeg on an investigation of corona losses with high tension direct current. Those investigations were made in the laboratory of the University of Liverpool, and the results presented there at Winnipeg; and Mr. Watson draws the following conclusions from those investigations, which may be interesting for you, viz.: That there is a definite corona stress over which loss occurs from a direct current line just as from an alternating current line; that the direct current stress required to produce a loss is the same as in alternating current loads; that the stress is substantially the same. For buried wires the electrical stress is much lower for negative than positive charges. That the corona stress is greater the smaller the wire, etc. That the loss is affected by the presence of water vapor in the atmosphere, especially for low values of the electrical stress, etc.

The results which Mr. Watson obtained agree very closely for direct current with those obtained by Professor Ryan for alternating current voltages.

Of course, as Mr. Watson says, while the paper is not complete, it shows that we have for direct current voltage high tension just as much to do with corona as with alternating current. I would like to ask Mr. Elwell if they have had any trouble from corona losses?

**C. F. Elwell:** The highest voltage there has been 57,000 from which you would not expect any trouble from corona on the line carrying 150 amperes; and the stations here are built (referring to diagram) but not put into actual operation. It will be interesting to watch what happens when they transmit at 93,000 volts. From my point of view I do not think that the corona loss is a very large factor. I do not think it will amount to much of a factor in this case. Of course if you went up to 150,000 volts you may find it to be considerable of a factor.

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In response to the pressing need for a simple and practicable treatise on the best methods of burning fuel oil, Mr. E. N. Percy has prepared the non-technical account which begins in this issue and will continue for several more. It comprises a condensation of the author's wide observation of current practice and consists largely of diagrams and illustrations of good and bad methods. Further contributions on the practical side of this question are invited from our readers.

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The wide-spread reports that the United States Navy has decided not to use the steam turbine in battleships on account of its lower efficiency as compared with the reciprocating engine have created a false impression in the public mind. The newspaper reports neglected to state that this low efficiency was due to the slow speed at which the vessels were run and to which the turbine is manifestly unfitted, as it cannot then be operated at maximum efficiency. This type of engine has materially increased the speed at which cruisers and scouts may be safely and continuously driven and is finding a wide field in marine use.

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The possibility of a wider application of the ground return for direct current machines is indicated in the discussion on high tension direct current transmission elsewhere in these columns. The drop in voltage in the thirty-five mile transmission between St. Maurice and Lausanne in France is eight per cent with copper return and five per cent with earth return. Direct current amounting to 150 amperes was transmitted at 27,000 volts during fourteen months without serious mishap.

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Electric power has effected an annual saving of $150,000 in the operation of six logging camps in Coos County, Oregon, which formerly employed steam power. These camps represent an investment of $450,000 so that this saving would pay for the entire investment in three years. This statement provoked so much interest at the recent Portland convention of the Western Forestry and Conservation Association that a committee was appointed with instructions to confer with the electrical manufacturers for the purpose of conducting practical experiments upon the application of electricity to logging.

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**Danger of Public Operation of Public Utilities.**

Seldom have the past results of public control of public utilities been so concisely summarized, their present so clearly portrayed, and their future so brilliantly forecasted as in Geo. A. Damon's address printed elsewhere in this issue. Mr. Damon's wide experience with the New York Commission, on the Pittsburg traction board and at Los Angeles has well qualified him to speak on this subject and gives to his remarks the added force of authority. Adequate service, in his opinion, is the great end in view and to his all other interests should be subordinated. Rate fixing is the last of the fundamentals to be considered. His suggestion with reference to the

dangers of public operation and the wisdom of university co-operation are especially opportune and worthy of careful consideration.

He contends that, while governmental regulation of public utilities may finally lead to governmental ownership it would be most injudicious to extend these powers to governmental operation. That public ownership will be the ultimate outcome of regulation few thinking men will deny, if for no other reason than the withdrawal of private capital into more lucrative fields. The moneys which should logically accrue from public participation in profits would here find appropriate investment. Such public ownership is the limit to sane socialism, beyond it, madness lies.

The folly of public operation is exemplified by the miserable service now being given by the British telephone system which has been under the supervision of the Postoffice Department and which will probably be taken over from the National Telephone Company during the next year. In the words of a Bostonian who has recently returned from England "the employees, not knowing what is to be done with them, are careless, the unhappy subscribers feel that they are going from the frying pan into the fire." So long as politics hold sway over governmental offices, good service cannot be their distinguishing feature. As a substitute Mr. Damon proposes that the operation be turned over to private companies working on a bonus basis. His suggestion has the hearty endorsement of many operating men.

His proposal of university co-operation with the work of the public service commission is in line with the Wisconsin plan of turning over the technical problems to the faculty of the State University. Excellent results have followed this practice and we believe the suggestion will meet the approval of all the well-wishers for the recently established commissions in the Western States.

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**Western Water Laws**

Many Western power companies will be interested in the decision of Judge J. T. Ronald at Seattle last week whereby the Yakima Irrigation Company was enjoined from diverting water from the south fork of the Snoqualmie River in accordance with the petition of the Seattle-Tacoma Power Company. The power company owns the land on both sides of Snoqualmie Falls at the site of its hydroelectric plant and claims the right to the use of all the river's natural flow. The court held that the riparian right is a property right and that the irrigation company, in order to procure any part of the flow that the power company does not use, must come into court by condemnation proceedings.

Thus is another link forged in the chain which bids fair to bind the West to the old English idea of riparian rights as contrasted to the California miner's right of appropriation. New evidence is here presented that the West is fast becoming a settled community and now feels the need for the laws more appropriate to that condition. A little history may not be amiss.

From the earliest times running water has been considered as free as the air and the light or as the birds that fly therein until it becomes private property by capture. The figurative beauty implied in the expression "taming the power of the water-fall" is surpassed in vividness only by its literal truth, "one of those truths spoken from the chest" as our German friends might remark. For what wandering animal is wilder or more ownerless than unappropriated running water, more amenable to man's control or freer when it escapes from restraint. This analogy is still further borne out by the many points of similarity between the game laws and those concerning water.

These laws, though legion in number, may be classified under two heads, the laws of riparian rights which the Romans bequeathed to the British and which they in turn transmitted to the early American settlers, and the laws of the right of priority of discovery, location and appropriation, which were an outgrowth of the conditions endemic to the California argonauts. The former, the English common law system, is applicable to well settled communities where private land holdings predominate; the latter, the crystallized customs of the pioneer miners, was adapted to the Western States and Territories where public lands predominated. Consequently we find that the right of appropriation was early incorporated in the constitutions of all the Western States in conformity to the precedent set by California.

Later, as more land passed into private ownership during the era of rapid development, arose questions contingent upon private land holdings and also upon the multiplicity of appropriations along the same stream. The early laws of appropriation proved inadequate to untangle this skein of legal controversy. The principles of riparian rights sufficed to settle many of these cases and so California again took the initiative in forming new laws to meet these new conditions. Many other Western States soon followed this example, but others, notedly Colorado, still cling to the laws clustered around the right of appropriation until today there are two opposing forces, those who favor the combined system of appropriation and riparian rights and those who recognize only the right of prior appropriation.

The former, or "California doctrine," rules in that State as well as in Washington, Montana, the Dakotas, Kansas and Oklahoma. The latter, or "Colorado doctrine," governs in Colorado, New Mexico, Wyoming, Utah, Idaho, Nevada, Arizona and Alaska. Oregon, Nebraska and Texas have partially adopted the laws of riparian rights but still favor the right of appropriation.

Opinion differs greatly as to which doctrine is more favorable to the development of the West or whether either tends to retard it. Recent decisions of the U. S. Supreme Court "recognize the difference of climate and soil which render necessary these different laws in the States so situated." However, it cannot be but a matter of a short time before the rapid settlement of the great arid West will quiet these contentions in favor of the dual system, as indicated by Judge Ronald's decision, especially as they are now being overwhelmed in the far greater question of federal control. But this is another story.

## PERSONALS.

J. A. Cranston, manager of the Portland office of the General Electric Company was a recent San Francisco visitor.

W. Brewster Hall, representing Pass & Seymour of Solvay, N. Y., has been calling on the trade at San Francisco.

C. E. Groesbeck, one of the vice-presidents of H. M. Byllesby & Co., with headquarters at Portland, Ore., was a recent San Francisco visitor.

Hans F. W. Rasmussen, formerly with Stone & Webster at Boston, has joined the new business department of the Pacific Gas & Electric Company.

S. P. Russell, manager of the electrical department of the H. W. Johns-Manville Company, spent the past week on a business trip through central California.

J. H. Hansen, designing engineer with the Pelton Water Wheel Company, spent the past week at Los Angeles and vicinity inspecting the plants of the Pacific Light & Power Company.

H. A Lardner, Pacific Coast manager for J. G. White & Co., of New York, has returned to his San Francisco office after visiting Tonopah to make an engineering report on a mine project.

Frank Loomis has resigned his position with the Pacific Coast offices of the Holophane Company to take charge of the electrical department of H. W. Johns-Manville Company's Portland offices.

Geo. R. Murphy, manager of the storage battery department of Pierson, Roeding & Co., has just returned to San Francisco, after spending six weeks on a tour of the Eastern and Northwestern States.

L. W. Booth, who is interested in the manufacture of the Lombard governor, has arrived at San Francisco from Boston and is visiting Pierson, Roeding & Co., the Pacific Coast agents for his company.

Robert Sibley and Rudolph W. Van Norden inspected the Borel plant of the Pacific Light & Power Company, this week. Mr. Sibley continued to Los Angeles while Mr. Van Norden returned to San Francisco.

James N. Campbell has taken charge of the supervision of the construction of the Oakland & Antioch Railway. His future headquarters will be at J. G. White & Co.'s construction office, 103 Edith street, Oakland.

C. Remschel has given up his connection with the American Electric Company at Seattle and will put in a large stock of electrical equipment and supplies in a new store he plans to open. He spent the past week at San Francisco.

Fred L. Johnston has resigned as city engineer of Santa Barbara Cal., to become supervising engineer over the transmission line which the Southern Sierra Power Company is building between Bishop and San Bernardino, Cal.

F. A. Richards, of the railway department of Pierson, Roeding & Company, has returned to the San Francisco office from San Diego, where he secured an order from the San Diego Electric Railway Company for 48 double trucks for electric street cars. A fine reinforced concrete power station, equipped with the latest type of steam turbine generator, is being completed. W. Clayton, vice-president and general manager of the company is authority for the statement that numerous extensions of the system will be made within the next few years.

Wynn Meredith, Pacific Coast manager for Sanderson & Porter, has gone to Victoria, B. C., to canvas the tenders opened Dec. 15, for the construction of a new water supply system. In his capacity as consulting engineer for the corporation of the City of Victoria, Mr. Meredith drew up the elaborate specifications and contract forms making a volume of 120 pages. The cost of this gravity system, which is to take water from Sooke Lake, is estimated at from $1,500,000 to $2,000,000. About sixteen million imperial gallons per day are expected to flow through the 30-mile conduit.

## FIRST MEETING OF ELECTRICAL DEVELOPMENT LEAGUE.

The first regular meeting of the newly formed organization of San Francisco electrical men, to be known as the "Electrical Development League" was held at Tait's Cafe on December 12 with a large attendance. Reports were received from several committees and their recommendations adopted as to Constitution and By-Laws and officers Geo. C. Holberton was elected president, H. V. Carter, vice-president and E. B. Strong, secretary-treasurer. The executive committee consists of these gentlemen together with C. C. Hillis, P. Decker, J. A. Vandegrift and W. W. Hanscom. Appointments on the various committees will be announced later.

This is an organization of individuals and not firms, its membership has no geographical limitation and all Pacific Coast electrical men are especially invited to join. Meetings are to be held monthly at the call of the president, the next being scheduled for January 9, 1912, at Tait's Cafe. Official headquarters are at the secretary's office, rooms 106 112 Rialto Building, San Francisco.

## OBITUARY.

George Barclay Moffatt, the man who conceived and carried to completion the Oregon Electric Railway project and who was the first president of that road, died at Portland, Ore., December 4, aged 57 years. He was identified in an official capacity with most of the large financial powers of New York, including the financial house of White, Weld & Company, and the Electric Bond & Share Company, of New York, of which he was a director. Until just before his western trip he was a director in the American Telephone & Telegraph Company. The banking institution of which he was the head, financed and controlled many industrial enterprises all over the country. Among the more important of these are the Portland Power & Light Company, the Portland Gas & Coke Company, the American Power & Light Company, of New York, and the Kansas Gas & Electric Company. He was a director of the two last named companies at the time of his death.

In an individual capacity and in association with W. A. White, his father-in-law, he operated and controlled the Washington Water Power Company, of Spokane, which supplies power to the street railway system of Spokane, a suburban line from Spokane to Medical Lake, and large power plants at Post Falls and in Spokane.

## ELECTRICAL CONTRACTORS' NOTES.

Frank Somers, manager of the Century Electric Company, of San Jose, was in San Francisco last Tuesday.

H. E. May, of the Electric Supply Company of Sacramento, was present at the Electric League Luncheon, Tuesday.

Contracts amounting to $127,941 have been let for an apartment house on Franklin, Page and Market streets, by Albert Lansburgh, architect. The electrical work will run about $5500.

W. S. Hanbridge, secretary-treasurer of Electrical Contractors' Association reports that a meeting of all the electrical contractors in the southern part of the State was held a Los Angeles, Saturday, December 2d and it was well attended from all points. After the meeting the contractors and their ladies became the guests of Mr. Chas. Hall, the genial representative of the Illinois Electric Company and viewed the electrical show. The meeting was a great success and a vote of thanks was extended to Mr. Hall.

The Newberry, Benheim Electric Company of San Francisco and Los Angeles, were awarded the wiring for the Pasadena High School for the sum of $21,000.

# INDUSTRIAL

## WESTINGHOUSE ELECTRIC CHAFING DISHES AND FRYING PANS.

The rapidly increasing use of electrically heated apparatus for domestic purposes has led to the design of various devices and modifications of those already designed. Examples of these are shown herewith in the frying pan and the blazier type chafing dish manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penn.

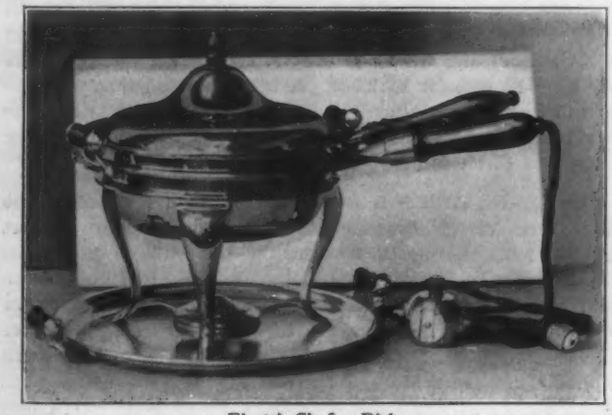
The frying pan is one of the most convenient cooking utensils that can be offered for use in homes, restaurants, hotels, etc. It is not only a complete frying pan, capable of cooking everything that can be fried in the ordinary manner, but it can also be turned into an electric disc-stove by simply inverting it and is then suitable for all kinds of light cooking, toasting, and similar uses.

Electric Frying Pan.

It is made of sheet steel and has a polished metal handle. The heating element is in the bottom of the pan and is hermetically sealed between steel walls so that it is completely protected from oxidation. The pan can be easily cleaned.

The pan heats quickly and can be run at three different temperatures—high, medium, and low. The desired temperature is obtained by means of an indicating push-button switch.

The stand is made of aluminum and is so designed that the frying pan can be run at full heat without injuring the surface of the table on which it is supported. The whole outfit is light.



Electric Chafing Dish.

The Westinghouse blazier type chafing dish is the most improved form of this ever popular utensil. In it there is absolutely none of the danger from fire and explosion which is always present when alcohol is used. The heat is uniformly distributed over the bottom of the pan, thus eliminating the overheated center and cold sides which are unavoidable when heat from a flame is used.

The dish can also be operated at three heats—high, medium, and low—and the temperature at each heat is always the same so that results once obtained can always be duplicated. It is always ready for use and consumes so little current that it is more economical than the alcohol-heated dish.

This chafing dish is similar to the ordinary type except that it has three pans instead of two—a water pan, a food pan, and a blazier. The water pan and the food pan are the same as used with the ordinary alcohol chafing dish.

The blazier contains the heating element hermetically sealed in the bottom. It is similar to the food pan in appearance and can either be used as a food pan for operations requiring high temperature, as in frying, or it can be filled with water and used to heat the food pan, which fits within it, when mild heat is wanted.

An indicating plug switch controls the temperature. The high heat is ordinarily used to bring the chafing dish to the desired temperature. The low heat will keep water boiling after the boiling point is once reached and is useful for keeping food warm. The medium heat is the highest that is usually wanted for most cooking in the blazier.

All metal parts are handsomely finished in polished nickel or copper. The handles are ebonized wood. The blazier is designed to fit the most popular sizes of chafing dishes and contains all the parts necessary for electrical operation. By its use the most popular makes of alcohol chafing dishes may be operated by electricity with no changes of any kind.

## TRADE NOTES.

Gas Kai is the title of a new monthly magazine devoted to the gas interests of Japan and published at Tokio under the editorship of S. Fijisaki.

Electrocraft, heretofore published at Detroit, Michigan, as a monthly magazine for electrical contractors has been absorbed by the Electrical Review and Western Electrician of Chicago.

## NEW CATALOGUES.

The Bridgeport Brass Co. of Bridgeport, Conn., are sending out postal cards telling of the advantages of "Phono-Electric" as trolley wire insurance.

Circular 1198, describing alternating current waterwheel generators, has been issued by the Westinghouse Electric & Manufacturing Company of East Pittsburg, Pa. The publication illustrates and describes the different types of generators, both vertical and horizontal, for waterwheel drive manufactured by that company.

The Sterling Electrical Mfg. Co. of Warren, Ohio, have issued an attractive treatise on the Mazda lighting system entitled "From Post Hole to Light On." The cost data embodied is especially valuable. The same company has issued a handsome pamphlet on "Warren Beautiful," the first city in the United States to adopt Mazda street lighting exclusively.

The Kellogg Switchboard & Supply Company, Chicago, are issuing a unique postal card booklet, with factory and branch office views that emphasize the personnel of its sales representatives. This little booklet, attractively printed in two colors, is a part of an ordinary mailing card and gives views of the factory buildings, mentioning briefly the equipment, the branch offices, with complete stock and shipping facilities.

# NEWS NOTES

## INCORPORATIONS.

BAKERSFIELD, CAL.—Bakersfield Water Company, $100,000, by E. L. Foster, L. E. Jordan, H. R. Person.

HOLTVILLE, CAL.—Imperial Southside Water Company, $200,000, shares $10 each, by C. D. Hartshorn, F. S. Best.

HOOD RIVER, ORE.—The Hood River Gas & Electric Company has been incorporated with $100,000 capital stock.

LOS ANGELES, CAL.—Needles Gas & Electric Company, $10,000, subscribed $300, by H. Torchiana, B. L. Devos, A. Mildreth.

SAN BERNARDINO, CAL.—Citrus Belt Gas Co., $1,500,000, subscribed $500, by F. P. Morrisin, E. D. Roberts, A. M. Ham and Z. T. Bell.

SAN FRANCISCO, CAL.—Merced River Electric Power Company, $10,000,000, by L. M. Cove, H. L. Breed, Chas. Fross, S. Hamilton and J. L. Bowes.

SAN FRANCISCO, CAL.—Haller-Cunningham Electric Company, $10,000, shares $10 each, subscribed $5000, by E. T. Cunningham, J. P. and G. F. Haller.

BOISE, IDAHO.—The Southern Idaho Light, Heat & Power Company has just been incorporated with a capitalization of $20,000,000. The prime movers in the organization are capitalists of Portland, Me.

## ILLUMINATION.

CHICO, CAL.—Sealed bids will be received by the Clerk of the Board of Trustees up to December 19th, 1911, for lighting the city of Chico.

PETALUMA, CAL.—The Pacific Gas & Electric Company will shortly commence work extending the electric line for two miles out in the vicinity of Church's Hill.

CRANBROOK, B. C.—The Empire Electric Company has secured the contract from J. McKay, of Athalmer, for the installation of an electric light plant at Athalmer.

REDLANDS, CAL.—It has been decided to install ornamental lights in the business section of the city. The cost is to be borne by the property owners and the city proportionately.

BOISE, IDAHO.—The Boise Gas Light Company's plant and business has been purchased by Kelsey, Berwer & Company, of Grand Rapids, Mich. Many improvements in the plant will be made.

BELLINGHAM, WASH.—The joint committee of the water board and the city council has decided to install an auxiliary lighting plant in connection with the city's power station which operates the electric pumps of the water department.

SAN JOSE, CAL.—The Sierra & San Francisco Power Company, has established offices in this city. The main line of the company passes through Alviso, and its nearest point to San Jose is about ten miles, but a branch line will be built into the city in a short time.

TROPICO, CAL.—The City Council has passed a resolution that public interest and necessity demand the construction and completion by the city of electric works. The cost which will be about $20,000, is too great to be paid out of the ordinary annual income of the city.

BELLINGHAM, WASH.—An ordinance has been introduced to the City Council, providing for an appropriation of $6000 for the installation of a municipal lighting plant. City Engineer Whitney asserts that a municipal plant will reduce the cost of arc lights from $54 to $25 per year.

MARTINEZ, CAL.—The Pacific Gas & Electric Company is spending several thousand dollars repairing and strengthening the lines between here and Concord. New wires are being strung along the line and steps being taken to protect the line from falling limbs, which in winter time cause the breaking of the power lines.

## TRANSPORTATION.

SAN BERNARDINO, CAL.—A bonus of $14,000 has been raised for building a trolley line from the northwest section of the city to the business district. It will be tendered to the Pacific Electric Company, and if refused will be offered to other companies.

WOODLAND, CAL.—An ordinance granting the right of way for the West Side Electric Railroad over all the public roads covered by the surveys has been adopted by the Supervisors in the name of J. Reith Jr., E. L. Sisson, H. W. Manor and L. P. Klemmer.

McMINNVILLE, ORE.—It is reported that the west side lines of the Southern Pacific will be electrified in the near future. It is understood that the lines will be equipped for electric cars as far as this place, both by way of Forest Grove and also on the Yamhill division by way of Newberg.

SANTA CLARA, CAL.—Manager F. F. Chapin of the Peninsular Electric Company has received word from Paul Shoup, manager of the Southern Pacific electric lines, that the application for an electric line to connect Santa Clara with the interurban system of Meridian Corners has been granted.

LA MESA, CAL.—Work on the San Diego, El Cajon & Escondido electric line is being pushed. G. W. Purcell, president of the San Diego & Escondido Electric Company, states that plans for trestles are being prepared in the office of the company. There will be five trestles in the strip between La Mesa and San Diego.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contract for furnishing 43 cars for the Geary Street Municipal Railway to the W. L. Holman Company, the only local bidder, for $337,000. It is understood that the matter will go to court since the Holman Company was not the lowest bidder, its demand being $50,000 in excess of that of the Jewett Car Company of Newark, Ohio.

PHOENIX, ARIZ.—A franchise has been granted to the Salt River Valley Electric Railway Company to connect Phoenix with the northeast part of the valley, the initial line probably terminating at Scottsdale. It also proposes to build a line to Glendale and the Northwest, and eastward to Tempe and Mesa. Entry to the city is to be by way of Adams streets. The promoters state that the power will be electricity from storage batteries.

BOSTON, MASS.—Stone & Webster report as follows on the October operations of the following companies: Puget Sound Electric Railway—Gross earnings, $154,752; decrease, $7008; net earnings, $17,826; decrease, $2854; surplus over charges, $6166; decrease $4497. Seattle Electric Company—

Gross earnings, $461,501; decrease, $7,532; net earnings, $201,-118; decrease, $28,275; surplus over charges, $85,184; decrease, $34,296. Whatcom County Railway & Light Company —Gross earnings, $34,506; decrease, $1114; net earnings, $16,-407; decrease, $1,071; surplus over charges, $5637; decrease, $688.

FRESNO, CAL.—Manager A. G. Wishon of the San Joaquin Light & Power Company, confirms the fact that a railroad is being built to Big Creek. The cost of the road will be about $1,000,000. It is not yet certain that the road will be brought all the way to Friant. It may be brought down to the plains by way of Little Dry Creek, and connect up with the Southern Pacific at the Fresno copper mine. The route cannot be determined until the surveyors get through with that part of it.

SAN FRANCISCO, CAL.—Suit has been instituted by the State of California against the United Railroads for the forfeiture of the franchise in California street from Kearny to Market streets. The complaint was signed by Attorney General U. S. Webb and City Attorney P. V. Long. Assistant City Attorney D. S. O'Brien is the nominal plaintiff. On account of the disuse of the rights the State asks that the franchise be declared forfeited and that the United Railroads in addition pay a fine of $5000.

## TRANSMISSION.

SANTA CLARA, CAL.—An ordinance was passed granting to D. O. Druffel, a franchise to construct and maintain pole lines and conduits for the purpose of transmitting electric current for power purposes.

SUISUN, CAL.—The Great Western Power Company, which has built an electric line from the Sierra Nevada Mountains to the bays, is considering the proposition of building a cable across Carquinez straits for the purpose of distributing its power in Solano and Napa counties.

WASHINGTON, D. C.—Early action is expected by Secretary Fisher on the application of the Great Western Power Company for permission to develop 55,000 h.p. of electricity on Feather River in Butte Valley, in the Plumas National Forest, Cal. The Forest Service has approved the plan as outlined in the application of the power company.

HOOD RIVER, ORE.—The Hood River Applegrowers' Union has purchased from Joseph A. Wilson his 175 horsepower waterpower system. The union plans an increase of from 300,000 to 500,000 boxes in its storage capacity next year and the power will drive the ice and cold storage machinery. The power system, the water of which is secured from Indian Creek, a tributary of Hood River, which empties into that stream near the city of Hood River, was constructed by Mr. Wilson in 1905. In addition to the power furnished to the growers' union, water and power is furnished to eight other business concerns in the city, and water to the O.-W. R. & N.

HOOD RIVER, ORE.—Justice of the Peace A. C. Buck dismissed the criminal charges preferred against T. E. Verco, a laborer, and Charles W. Gill, line foreman of the Hydro-Electric Company, by Albert S. Hall, Hood River, manager of the Pacific Power & Light Company, for an alleged criminal destruction of property. The Hydroelectric Company's new line, the poles of which the laborers were setting into Portland, parallels the line of the Pacific Power & Light Company, which carries a current of 2200 volts. At the Indian Creek bridge, in order to raise their line above that of their competitors, the Hydro Company was forced to erect poles 65 feet in height. The foreman, Gill, found that it would be impossible to set the poles without guy wires coming in contact with the live wires, and to prevent danger to men and probable damage to the Pacific Power & Light Company's wires, he removed plugs a short distance from where his crew of men was at work and cut off the current, which, according to statements of Hill, left 60 of their customers without electrical energy for a period of about four and a half hours. This act was alleged malicious. The removal of the plugs was admitted by the defendants, but a lack of malice was avowed.

## TELEPHONE AND TELEGRAPH.

SUSANVILLE, CAL.—The California Telegraph & Telephone Company has been busy lately putting in operation new lines and exchanges.

WATSONVILLE, CAL.—The people of the Carlton district have about completed arrangements for the installing of a private telephone system in that section, which will connect with the central office of the Pacific States Telephone & Telegraph Company, at Watsonville.

TACOMA, WASH.—Following President Theodore N. Vail's visit here this week, the Bell telephone interests today wiped out competition in Tacoma and Bellingham at an auction under Federal Court authority. The holdings of the Home Telephone Company of Puget Sound at Tacoma and Bellingham were purchased by the Sunset Telephone Company, a subsidiary of the Pacific Telephone & Telegraph Company, for $550,000. Mayor Seymour wanted the city of Tacoma to organize a holding company and purchase the Home telephone plant, but could not do so without authority of the Legislature. He says he has an understanding that the city can purchase the Home plant from the Bell interests if Tacoma so desires later.

## WATERWORKS.

ELMA, WASH.—All bids for the construction of the water system were rejected by the City Council.

STEVENSON, WASH.—The City Council has passed an ordinance providing for the purchase of the waterworks of the Stevenson Water & Improvement Company.

SPOKANE, WASH.—Plans are being drawn by a Spokane engineering firm for a waterworks here costing about $11,000 to be located on Howerton hill, northwest of the town.

EUREKA, CAL.—There has been filed with the County Recorder a water appropriation of 5,000,000 inches, made by K. Geer on water flowing in Ben Valssade creek, to supply inhabitants of the city of Blue Lake.

WOODBURN, ORE.—The sale of $25,000 waterworks bonds was negotiated here by the City Council to an eastern bonding company. The water system will be taken over by the city and extensions to the amount of $15,000 made during the next year.

KLAMATH FALLS, ORE.—The city intends to take up 500 miner's inches of water from the springs at Rock Creek and Aspen Lake, which are 30 and 28 miles distance respectively. The water will be taken from nine streams that are capable of supplying the city's needs for many years. It will be piped to this city.

REDLANDS, CAL.—Engineer F. E. Trask, appointed by the City Trustees some time ago to take up plans for a municipal water system for Redlands, to investigate the value of systems that can be acquired and to report on these systems, has accepted the contract and will begin work in a few days. He will receive $3000 for his work and $200 additional in case bonds are voted and he carries out the work on the system.

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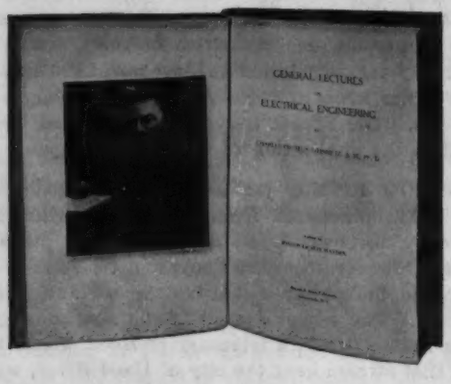


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